72-10919-01 Rev. 1

OPERATION and MAINTENANCE MANUAL



VECTORBEAM

33441 CENTRAL AVE. / UNION CITY, CA 94587 / (415) 4 [illegible]

INSTALLATION

INSTALLATION

Your new VECTORBEAM game has been designed to give you years of trouble free operation by utilizing proven solid state technology combined with rigid quality control throughout the manufacturing process.

Prior to installing your new game carefully remove the game from the shipping carton and inspect the cabinet for any external shipping damage such as dents or scrapes. Report any shipping damage immediately to the carrier and VECTORBEAM.

Two sets of keys are included with each game in an envelope taped to the control panel. Replacement and/or extra keys are available from VECTORBEAM upon request. In addition to the coin mechanism lock, the coin box itself is constructed to allow use of a padlock for addition security.

Your VECTORBEAM game may be powered from any three wire AC service outlet that will supply approximately 175 watts of power. The game has been pre-set to operate at the AC voltage specified on the decal located on the rear panel decal. If in doubt about your AC power source, check it with an AC voltmeter prior to applying power to the game. It is a good practice to test the AC service outlet with combination receptacle circuit and ground fault tester prior to use. These are inexpensive devices that indicate voltage and correct wiring.

If your AC power is not the same as specified on the decal the power supply may be re-strapped to any of the three voltages specified in the AC Line Voltage Selection Table. If operating the game on any AC line frequency other than 60 HZ check the lamps and lamp ballasts to insure that these devices are rated for your line frequency.

The cabinet should be located within five feet of your AC service outlet if you plan to use the game without an extension cord. If an extension cord is to be used it should be of the minimum length necessary and should be of heavy duty three wire construction.

The warranty is void if the game is used with the third wire ground prong broken off the line cord. This is an unsafe condition and must be corrected. Line cords are available from VECTORBEAM to replace damaged or broken cords.

Your game will power up as soon as the line cord is installed in the AC service outlet. The game, after it is properly installed, should be checked operationally by performing the following procedures:

1. Prior to applying power to the game remove the rear door and check to insure all connectors are firmly seated.

2. Check the power supply fuses to insure that they are correctly installed and are of the proper rating.

3. Plug in the AC line cord. Since the rear door is off, the interlock switch on the rear door cleat will be defeated and no AC should be available at the power supply. To defeat the interlock when the door is removed, pull the white plunger out. Allow the cathode ray tube (CRT) one to two minutes to warm up.

CAUTION

When the rear door is off and the interlock defeated there are high voltages present in the game. Do not attempt to remove or reseat connectors in this mode. Always have the AC disabled when removing or reseating connectors.

4. Observe that the display is active and all lamps are functioning. If there is no display refer to the Maintenance and Adjustments and Trouble Shooting chapters of this manual.

5. Your Vectorbeam game is equipped with an option switch located on the Logic Printed Circuit Board Assembly. This switch has been pre-set at the factory. Refer to the Option Switch Table in the Game Play chapter of this manual for the various settings.

6. Open the coin door and trip either mechanism, the coin counter should increment each time the trip wire is activated. If the game is set for more than one coin the coin counter will still increment but the game will not be enabled until the correct number of coins have been inserted. Refer to the option switch table in the game play chapter of this manual for multiple coin options.

7. After the game has been activated the game will be in Play Mode. The audio and controls will be active at this time. Refer to the Game Play chapter of this manual for display and audio adjustments. Follow the game play description to insure all functions are operational.

8. After any display and audio adjustments are made, replace the back door and make final placement of the game. If the game is not level it may be necessary to shim the bottom of the cabinet to prevent rocking.

Game Description

WARRIÖR

Introduction

"WARRIOR" is a two player vector generated video game designed to give the player realistic sword fighting action. The three dimensional effects brought about by the playfield and the high video resolution of the VECTORBEAM™ monitor are only part of this. The feeling of realism is also brought about by the energy hum in the audio circuit and the spectacular artwork by renowned fantasy artist Frank Brunner. The following paragraphs explain how the game plays.

Game Play

There are two modes of operation to your "WARRIOR" unit: The Attract Mode and Play Mode. The Attract Mode is activated when power is applied or a game has ended. The Play Mode is activated when coins are accepted and play is ready to begin.

1. Attract Mode

The Attract Mode appears on the monitor screen a few seconds after the monitor is powered up or at the end of a player's game. As the Attract Mode begins, the swordsmen materialize in their "safe zones". From there they move up the stairway to their immediate right. (Notice how the swordsmen get noticeably larger as they ascend the staircase and noticeably smaller as they decend it.) They then proceed to the center of the screen (between the "bottomless" pits) where they raise their swords and begin fighting. One swordman will then explode and the surviving swordsman falls into one of the "bottomless" pits. The Attract Mode exists to give the prospective player an idea of how the game is played, and also serves to show the operator that the safe zones, pits and staircases are aligned correctly.

2. Play Mode

The Play Mode is activated when the players' coins are accepted. Players insert two quarters for the first ten (10) time units and each additional quarter gives ten additional units. The duration of the time units is set by the operator (for instructions, see "Operator Option Switch" at the end of this section).

Time units are displayed on the bottom center of the display. Scores are on the top left and right.

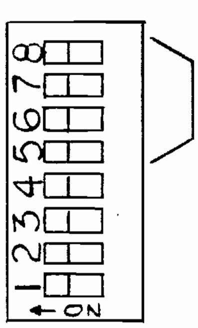
The object of the game is to score points in one of two fashions: a.) by touching the center of your opponent with the end point of your sword or b.) by forcing your opponent into one of the "bottomless" pits. Each of these scoring moves scores one point. The player with the highest total at the end of the game is the victor and his score will flash brighter and dimmer when the game is over.

Each swordman is controlled by the joysticks on the player control panel. at the top of each joystick is a black push button. Moving the joystick without the button depressed moves the swordsman's body in the corresponding direction. Moving the joystick with the button depressed moves the end point of the sword in the corresponding direction. The swordsman's body and sword cannot be moved simultaneously.

When a point is scored, the scoring swordman remains in place. The swordsman scored upon reforms in his respective "safe zone". Both swordsmen must be outside their "safe zone" to be scored upon.

OPERATOR OPTION SWITCH

The operator option switch is located on the Logic PCB. This switch allows the operator to set the game time to 30, 60, 90, or 120 seconds, set the coin acceptor to one or two coins and also to display an alignment image on the CRT.



NOT USED

On = 1 Coin Off = 2 Coins

On = Allign Image Off = Normal Play

$\frac{\text{On}}{\text{On}}$ = 120 Sec. $\frac{\text{On}}{\text{Off}}$ = 90 Sec. $\frac{\text{Off}}{\text{On}}$ = 60 Sec. $\frac{\text{Off}}{\text{Off}}$ = 30 Sec.

Maintenance

MAINTENANCE and ADJUSTMENTS

1. Cleaning
VECTORBEAM is proud of the appearance of your new game. To keep it looking "fresh" periodic cleaning is recommended.
Use a non-abrasive household cleaner diluted with warm water, a soft cloth and a little effort will keep your game attractive for years.
Care should be exercised when cleaning the player control panel, decals and plex. These surfaces can be marred and scratched if subjected to abrasives.

2. Coin Mechanism
a. Coin Counter
The coin counter, located next to the coin box, is a highly reliable electro-mechanical counting mechanism that is incremented by the electronics. No maintenance is required for this device. By opening the coin-door you can insure proper operation by toggling the coin mech and observing the counter increment.

b. Coin Mechanism
To insure proper operation of the coin mechanism is is necessary to periodically clean the coin path of residue that builds up. Do not use abrasive brushes. Hot soapy water and a toothbrush followed by clean water flushing will remove the residue build-up. Use compressed air to blow dry the mechanism. Do not use lubricants as this will result in a rapid build-up of residue in the coin path.

c. Troubleshooting
Jammed coins are the most common problem with coin mechanisms. After removing the coin examine the mechanism to determine the cause. Remove any foreign objects such as gum or paper wads and clean the coin paths.
Failure of the coin to register can usually be corrected by adjusting the trip wire. In some cased is may be necessary to check the coin mechanism wiring to insure the connectors are firmly seated.
Failure of the electronics to register the coin is very rare. If the mechanism and wiring appear to be functional the logic may be examined by use of an oscilloscope. Refer to the logic schematic for coin register circuit diagram.

3. Fuse Replacement
There are two fuses contained on the power supply. These fuses are accessible through the rear door. Prior to replacing or checking fuses insure that power is off. Always replace fuses with the same type and rating.

4. X & Y Gain Adjustment
Refer to Display Assembly drawing for component location.
a. Set game in Adjust Mode (see Game Play for switch setting.)
b. Turn X gain trimpot R60 until display is centered to pits.
c. Turn Y gain trimpot R54 until display is centered to pits.

5. Centering Display
In some cases it will be necessary to move the yoke radially on the CRT neck to obtain perfect centering.

6. Plex Removal
Remove the two button head screws securing the plex to the cabinet. Push plex up to clear the joysticks then pull bottom of plex over the joysticks and clear of the cabinet. In some cases it may be necessary to loosen the control panel in order to free the plex.

7. Control Panel Removal
If the control panel is damaged or is malfunctioning it is necessary to remove the assembly to gain access to the joysticks.
   a. Turn off power.
   b. Disconnect the coin door harness. Unplug joystick connectors.
   c. Remove the hex nuts and carriage bolts on the sides of the control panel.
   d. Remove the control panel assembly from the cabinet.

8. Joystick Adjustment
Determine which joystick and function is non-operational. If the malfunction is caused by the pushbutton switch located on the top of the joystick handle the grip may be removed and the pushbutton switch loosened and removed for repair or replacment. If the malfunction is due to the failure of one of the four leaf switches controlling the movement of the Warriors, it is necessary to remove the control panel in order to re-adjust or replace the leaf switch.
To adjust the leaf switch use a pair of needle nosed pliers and bend the stationary leaf only. Insure that all of the terminals attaching the harness to the joystick leaf switches are firmly seated and not shorting.

9. Lamp Replacement (turn off power)
   a. Flourescent Lamp
Remove the rear door and insure no power is available to the game. Remove the two stopblocks securing the playfield bezel. Fold the playfield bezel up to clear the lamp carrier.
Remove the flourescent black light and replace with lamp of the same rating; F15T8/BLB. Re-install the carrier, stopblocks and rear door.
   b. Top Lamp
Remove the rear door and insure no power is available to the game. Remove the top lamp and replace with a lamp of the same rating; F15T8/CW or F15T8/WW.

VECTORBEAM MONITOR OPERATION

The VECTORBEAM^{tm} monitor can be divided into two basic sections. One section is the deflection amplifiers, and the other section is the high voltage and cathode drive circuit.

The deflection amplifier can be further divided into two identical channels: one for vertical deflection, and one for horizontal deflection. We will describe the operation of only one channel (vertical) and the same theory of operation will hold true for the horizontal section.

Digital information, in the form of a twelve-bit word, is applied to the input of the DAC-80 digital to analog converter U5 on pins one through twelve. The most significant bit (MSB) is applied to pin one, and the least significant bit is applied to pin twelve. The DAC-80 makes the necessary conversion from digital signals to analog signals which are outputted as analog voltage signals on pin fifteen (which is proportional in level depending on the input word applied). The result is a positive and negative voltage signal about its reference voltage (remember, there is no "sync" signal present, and the signal is not true video as seen in raster scan monitors).

From the DAC-80 the analog signal is then sent to a high-speed analog switch, U3. The analog switch has two parallel inputs for the display signal, and two controlling inputs which select one of two outputs from the switch. At the outputs is found an R.C. network, which is used to create line length and line position on the screen.

Output fifteen from the switch routes the analog signal through a 5K potentiometer R58, a 10K resistor, R59 and to the input of U4 op-amp. The time constant developed by these two resistors and the capacitor C35 determine the length of the vector line seen on the screen. Adjusting the potentiometer will adjust the length of the vertical lines seen on the screen.

Output ten from the analog switch routes the signal directly to the input of U4 op-amp, and the resulting time constant of the op-amp input impedence and the capacitor C35 determines the position on the screen of the vector line.

Op-amp, U4 serves a dual purpose: one, it acts as a buffer between the deflection amplifiers and the analog switch; and two, it acts as an "edge gain" amplifier (i.e., height).

At the output of U4 there is a resistor amp, diode network consisting of R52-R57, and CR27-CR30. This resistor diode network is used to compensate for the non-linear characteristics of the CRT near the edges of the screen. If this circuit were not used, any object displayed on the screen would increase in size as it moved closer to the edges of the screen. Also contained in the circuit is a potentiometer R54, which adjusts the height of the pictures.

From the wiper of R54, the signal proceeds to Q17, which is the first stage of deflection amplification. Q18 is emitter coupled with Q17 to provide a degenerative feedback loop from the yoke. Q16 is used to proved a constant current source to both emitters.

At this point, the deflection circuit can again be divided into two identical circuits. One circuit, which controls the lower half of the screen, is comprised of Q8, Q9, and Q10. The other circuit, which controls the upper half of the screen is comprised of Q7, Q12, Q6, and Q111.

Q8, Q10, and Q110 are three stages of amplification, while Q9 is used as a current limiting protection for Q10 and Q110. The same holds true for the other configuration of Q7, Q6 and Q111. R23 through R28 are used as a current divider network for the yoke.

In the horizontal section of the deflection amplifier, Q3, Q2, Q1, and Q210 control the left hand side of the screen, and Q4, Q11, Q5, and Q211 control the right hand side of the screen. By dividing the screen in this manner, four quadrants of deflection area have been developed (see vector theory chapter.)

R38 and C37 form an R.C. network, which compensates for any CEMF that may develope by the expanding and collapsing of the deflection coil's electromagnetic field.

The high voltage and cathode circuitry is the second section of the monitor. This section also contains the necessary voltage regulation to power the IC's located on the display board as well as develop the high voltage.

U10 and U11 provide plus 15V and minus 15V respectively to power the DAC-80's and the TL081 op-amps on the diplay board.

U9 and U12 provide plus 18V and numus 18V used in the high voltage transformer (T-1) and oscillator (The oscillator circuit is necessary because there is no horizontal sync used to develop the high voltage pulses.) The oscillator circuit is comprised of primary windings, Q31 and associated discreet components. U8 provides the plus 5V for the 7406 and protection circuits.

The high voltage 18KV is developed by T1 secondary windings, the high voltage tripler, and the focus circuitry. The potentiometer, R92, is used to adjust the focus of the cathode beam.

One of the secondary windings of T1 develops the necessary cathode voltage, which when measure at the cathode of CR51 should read 88VDC. The cathode circuitry in the VECTORBEAM™ monitor is comprised of U6, a 7406 IC used for buffering logic signals which control brightness and blanking. It also contains the transistors, Q20 and Q21, and Q22, and then associated discreet components.

Q20, and the first gate of U7 control the brightness of the cathode signals upon command of the CPU logic board. Q22 and the second gate of U6 control the intensity (blanking) of the cathode signals, also upon command of the CPU board. Q24 is used as a power failure protection for the cathode circuit in the event of a loss of 25V power supply voltage. This protection aids in avoiding phosphor burning on the CRT. R91 is the brightness potentiometer, which adjusts the amplitude of the negative going spikes used for brightness and intensification.

THEORY OF OPERATION

WARRIÖR

CPU BOARD

The processor hardware can be broken down into five basic functional blocks as shown in Figure 1. The arrows indicate the possible data flow directions between the various blocks. The ALU and Control block are the main components of the processor while the Memory and I/O blocks may be thought of as merely peripherals. Figure 2 is a detailed block diagram of the processor. The numbers in each block correspond to the entires in Table 1, which lists the IC numbers of the main components of each functional block.

The following is a brief description of each block shown in Figure 1. The numbers beside each functional block name are the numbers in Figure 2 which correspond to a particular function.

<u>RAM (6)</u>

The RAM is implemented with three 9101C read/write static memories configured as a 256 x 12 bit block. Data can be transfered to or from this memory via the ALU block. The processor uses this RAM as a scratch pad.

<u>ROM (10)</u>

The ROM is configured as an 8k x 8 bit block of memory. These memory locations contain the program instructions and/or data. It is accessed via the processor control unit.

<u>IO 19, 17, 18</u>

The I/O block consists of 8 input lines implemented with a bit addressable latch, 24 input lines implemented with data selectors, and two 12 bit registors which are connected to the X Y display deflection circuits via D/A convertors.

Arithmetic Unit 1,2,3,4,5

The arithmetic unit performs all the arithmetic processing for the system. It consists primarily of two 12 bit accumulators, an arithmetic logic unit and various data selectors. The accumulators can function as temporary storage registers for arithmetic calculations, or as the source and destination registers for I/O operations. The ALU performs the actual arithmetic functions upon the data in the accumulators. The data selectors are used to select the various sources of data which will be processed.

Control Unit (15, 16, 14, 7, 8, 9, 11, 12, 13)

The control unit is the heart of the processor. It performs all instruction decoding operations and generates all the necessary control signals which the rest of the hardware requires to function correctly.

The following is a discussion of each block shown in Figure 2.

1. Accumulator Selector

The accumulator selector consists of 3 quad data selectors. They are used to select the output of either the primary or secondary accumulaotr for processing by various other sections of the system.

2. & 3. Primary and Secondary Accumulators

The two 12 bit accumulators are implemented with quad bidirectional shift registers. The primary accumulator consists of S4, P4, M4. The secondary accumulator consists of T4, R4, N4. All data manipulation in the processor is accomplished using these two accumulators. All output data flows through these registers.

4. Arithmetic Logic Unit (ALU)

The ALU is used to perform all necessary arithmetic functions within the processor. The ALU is implemented using three 25LS181 (N6,M6,L6) function

generators, three 74LS85 (N9 M9, L9) 4 bit magnitude comparators, and a 74S182 (L4) look ahead carray generator. The data which the ALU manipulates can come from four different sources. The first source is the contents of the accumulators via the accumulator selector. The second and third sources are the ROM and RAM data outputs via the ALU data selector (N11, M11, L11) and the fourth source is the external input lines via the input selector (E4, D4, C4).

5. Data Selector

The data selector is used to read data into the ALU from either the RAM or ROM memory. Note that the ROM data is only 8 bits wide while the RAM data is 12 bits wide.

6. RAM Storage

The system RAM consists of three 9101C high speed static memory chips connected as a 256 x 12 bit block. The block is 12 bits wide in order to allow the contents of an accumulator to be stored. The processor uses the RAM as temporary storage of program variables, data pointers or any other data of a dynamic nature.

7. RAM Address Selector/Register.

The output of this register is tied directly to the address lines of the RAM. It consists of a multiplexer which routes address data from either the ROM or RAM locations to the RAM address lines. The capability to use RAM data to select RAM addresses is the basis for the indirect addressing mode of the processor.

8. Page Selector

The page selector is used to latch the high order 4 bits of a RAM address during some types of RAM access instructions.

9. ROM Data Register

This register is used to temporarily hold data from the ROM during an instruction fetch.

10. ROM Memory

The ROM memory consists of the actual memory chips plus a data selector and latch circuit. The latch is used to improve the memory access time during a two byte instruction fetch by allowing one byte of the instruction to be latched while the RAM address lines are decoded for the other byte. The data selector can then be used to rapidly access both bytes of the instruction b y switching between the latch and memory outputs.

11. Instruction Register

The instruction register is a latch which holds the current op code as read from the ROM. Its output is tied to the instruction decode circuitry which in turn generates the necessary signals to execute the instruction.

12. System Sequencer

The system sequencer is used to decode an instruction op code and to generate the appropriate timed sequence of signals which execute the instruction. The op code is decoded by using it as the address data to a set of decoder ROMS. The outputs of the decoder ROMS are then synchronized with the system clock and used to control the various system functional blocks.

13. Line Length Counter

The line length counter is used during the process of drawing a vector to control the length of a vector, by turning off the beam at a predetermined time after the vector is initiated. The counter is loaded with a value from a line length ROM and then counts up until it overflows which in turn generates a signal to indicate the vector has been finished.

14. Program Address Selector

This selector is used to provide the address data to the program ROM. It selects either the program address counter output or the accumulator selector output and routes this data to the ROM address lines. The ability to use the accumulator contents as address data allows the program to randomly access data tables stored in the ROM or to compute a branch address after a conditional test.

15. Program Address Counter

This is a 12 bit counter whose output defines the next location in ROM to be accessed. It is normally clocked sequentially to step through a program. However, it can be loaded with data from the program address register which is how the jump instructions are implemented.

16. Program Address-Register

This register is a latch used for temporary storage of an address which will be loaded into the program counter during a jump instruction. The input data to this latch can come from either the program ROM or the scratch-pad RAM.

17. Input Selector

The input selector is used to read the state of one of the 24 input lines into the selected accumulator. There are 16 primary inputs and 8 secondary inputs. During an input instruction the upper 11 bits of the accumulator are set to zero while the least significant bit reflects the state of the input line. All input lines have pull up resistors on them so that they will read high if they are left unconnected.

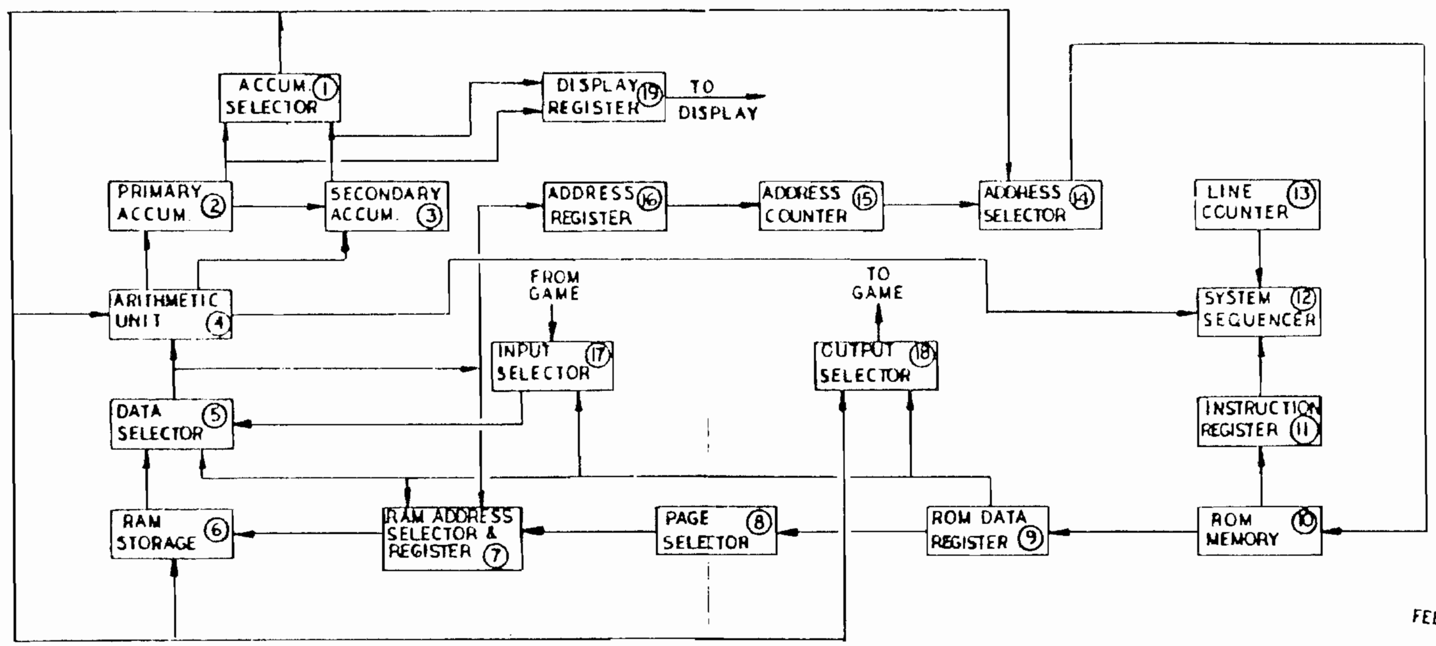
18. Output Selector

The output selector is a bit addressable latch used to control the 8 output lines. During an output instruction the selected output line is set to the complement of the least significant bit of the accumulator. The output lines are used to control the audio board, display intensity and the mechanical coin counter.

19. Display Registers

The display registers are the interface between the processor and the display driver circuits. These registers are latches into which the contents of the accumulators can be stored. The outputs are tied to D/A converters which provide the input voltage to the display deflection amplifiers.

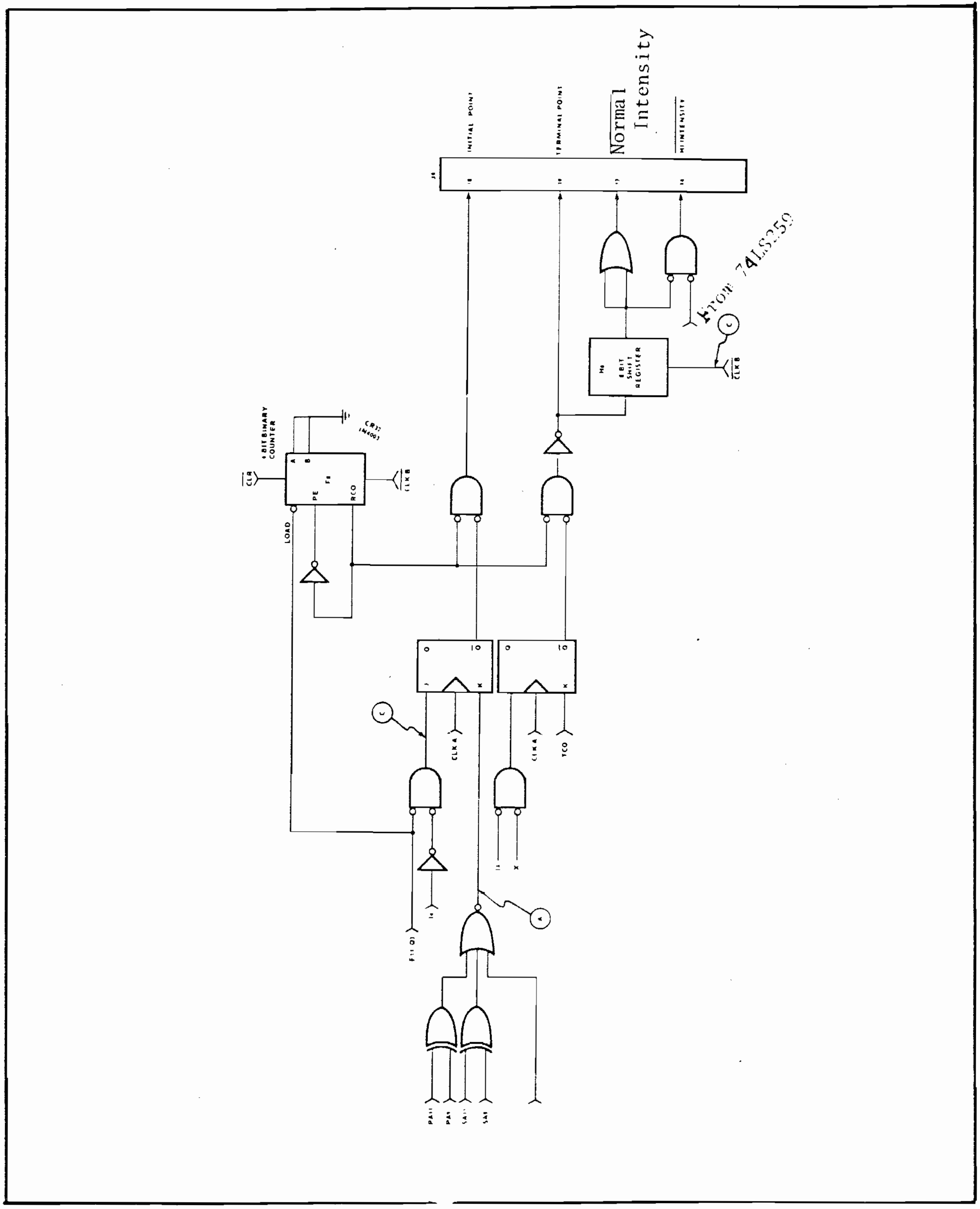
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



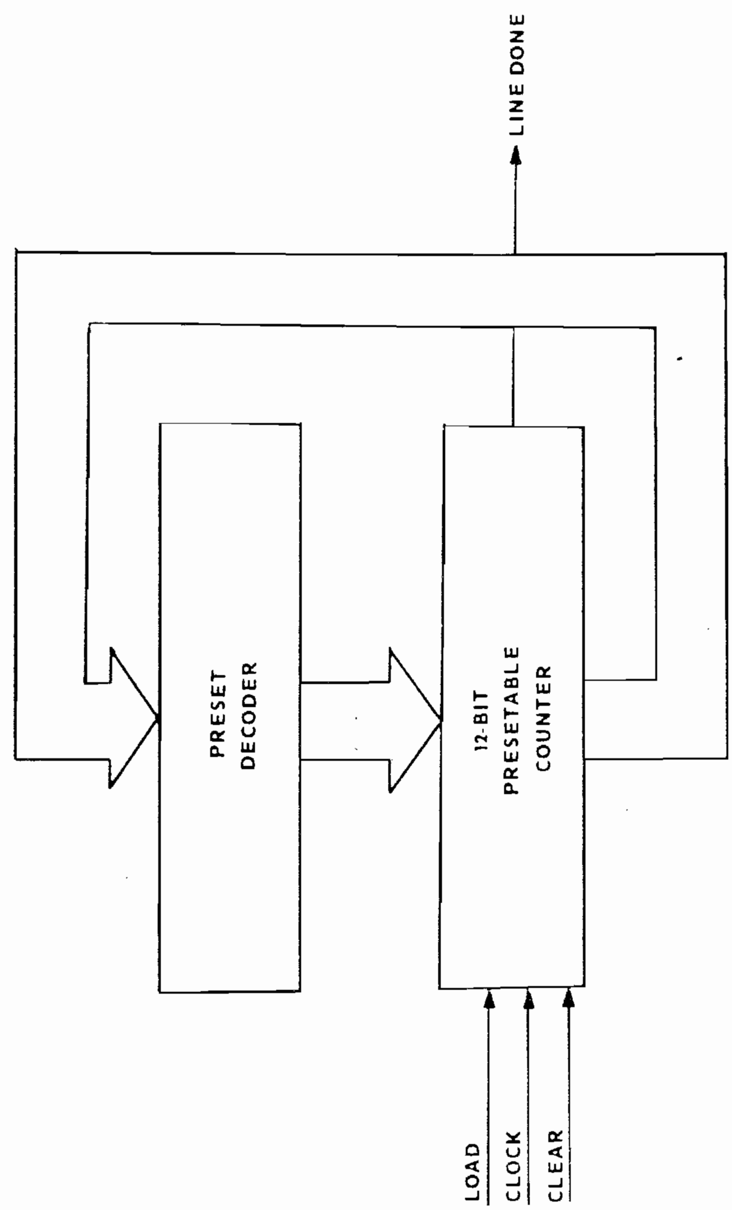
FEB 28 1979

MATERIAL:	DRAWN BY: S. HURLBERT	DATE 2-79	**VECTORBEAM**
	PROJECT ENGR:	DATE	DWG TITLE BLOCK DIAGRAM CPU BOARD - DETAILED
FINISH: BREAK ALL SHARP EDGES AND DEBURR ALL HOLES.	RELEASE APPROV:	DATE	
	DO NOT SCALE DWG		
	TOLERANCE: UNLESS OTHERWISE SPECIFIED		MODEL NO. / DWG SIZE B / DWG NO. BD201000 / REV.
	PROJECTION:	SCALE: NONE	CODE IDENT. / SHEET 2 OF 2

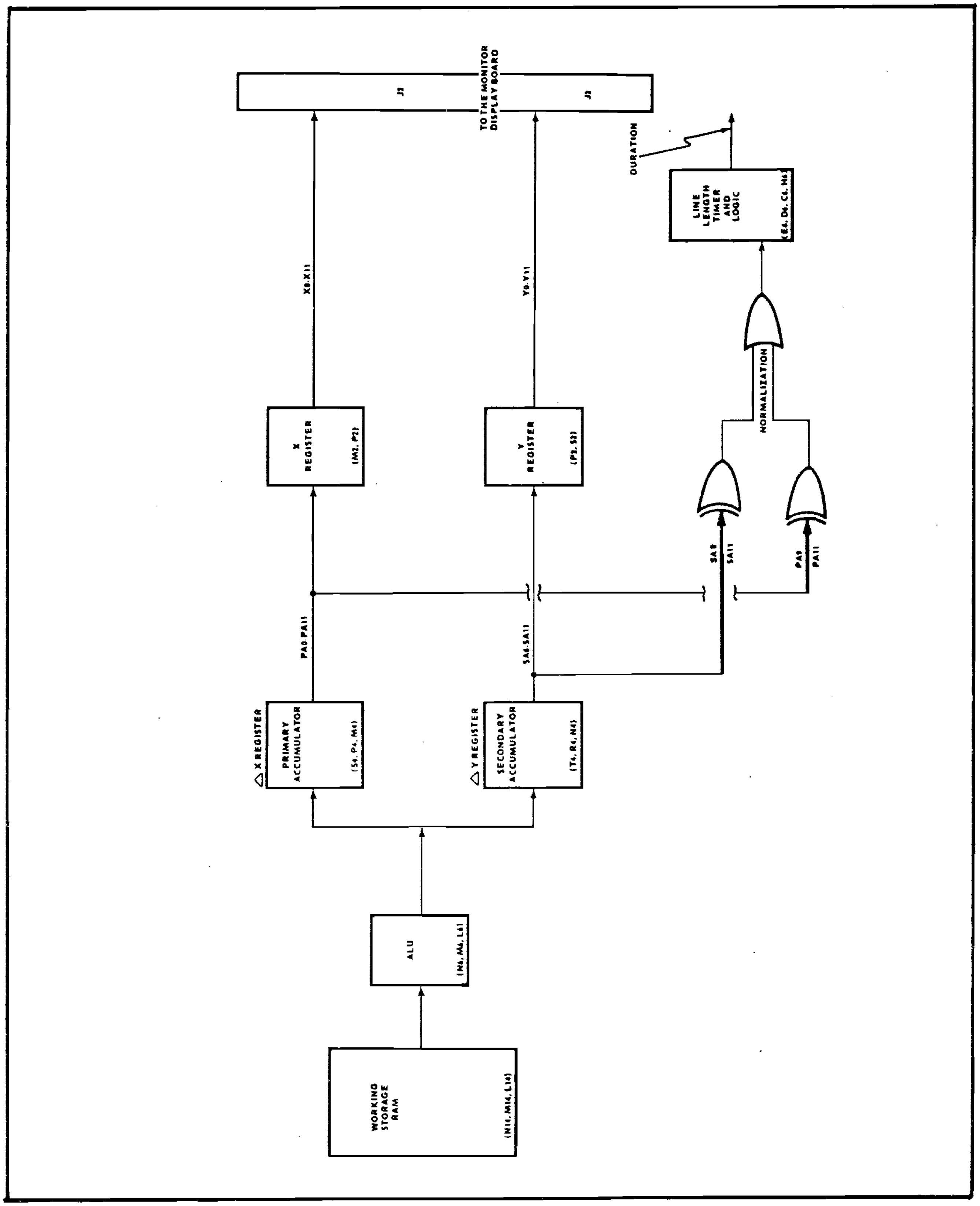
BRUNING 40-21 40423



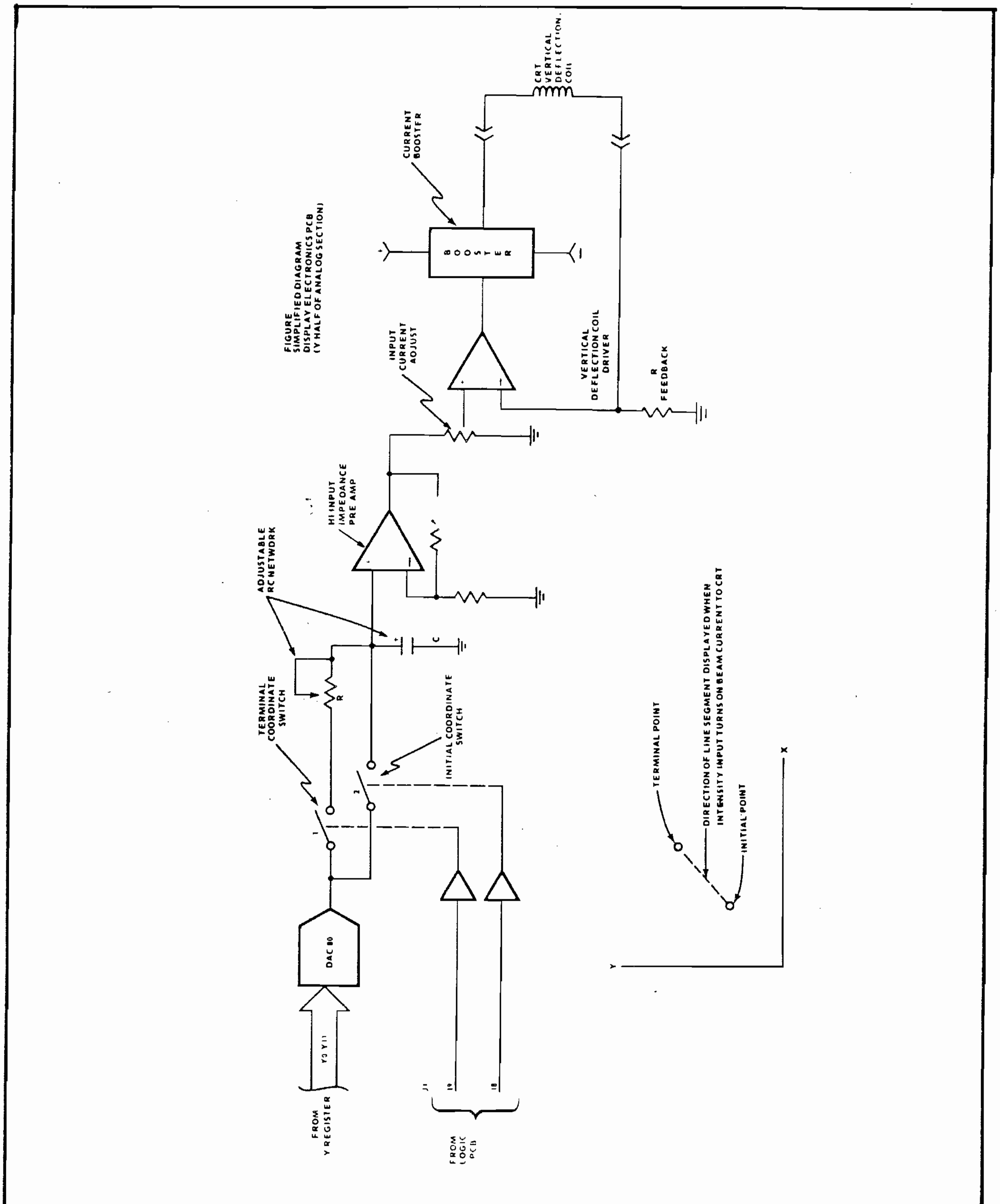
Simplified Block Diagram of The
System Sequencer Display Section



Simplified Block Diagram of
The Line Length Timer



Vector Generator Block Diagram



Simplified Block Diagram of
The Display Electronics PCB
(one-half analog section)

WARRIOR Audio Board

The WARRIOR Audio Board is a self contained electronic sound generation system that requires connections only to external power, control and loudspeaker. Sounds generated include a pit fall, explosion, reappearance hiss and two levels of sword hum.

The audio power amplifier consists of the op-amp IC19, power transistors Q6 and Q7, capacitors C38-C40, and resistors R58-R62. The volume is controlled by potentiometer R63. The circuit can drive and 8ohm loudspeaker to approximately 8 watts RMS power.

Each sound is enabled by a command from the logic PCB via a 16 pin ribbon cable to connector J2. Power and speaker output are connected through the 9 Pin molex connector J1. Two on board voltage requlators supply the +15VDC and -15VDC to the circuits.

The wideband noise generator is used as a white noise source for the sword hum, explosion and reappearance hiss. The wideband noise generator consists of the diode D1, IC5-7 and their associated circuitry.

The explosion circuit is triggered by a 400ns pulse from connector J2 pin 14 to pin 2 of IC 4 which enables IC 2 for the duration of the explosion (approximately 1.5sec.).

The reappearance hiss is generated by J2 pin 15 to IC 8 pin 12. The output of IC 8 pin 12. The output of IC 8 pin 11 will allow the reappearance hiss sound to be enabled through IC 3 as long as IC 8 pin 13 is held low.

The sword hum circuit generates two levels of sound; sword hum high and sword hum low. The low sound is generated by a low logic level on J2 pin 11 which enables IC 3 pin 3 which will then apply a voltage on the amplifier bias imput of IC 13, pin 5. When J 2 pin 12 goes to a low logic level it will enable IC 8 pin 6 increasing the voltage to the amplifier bias input of IC 13 pin 5. The input to IC 13 is the free running sword hum noise generator comprised of IC 9 and its associated circuitry and the output of the wideband noise generator.

The pit fall circuit is enabled by a low logic level on J 2 pin 14 triggering the one-shot IC 14 and enabling the output of the pit fall circuitry to be gated by IC 8 to the op-amp IC 18.

APPENDIX A

REFERENCE SCHEMATICS

TROUBLESHOOTING CHART

PROBLEM	PROBABLE SOLUTIONS
CIRCUIT BREAKERS BLOW	Disconnect AC line power to Display PCB If breakers continue to blow, check for shorted speaker coil Check logic PCB for lighted LED, located near power connector LED should not be on Measure voltage at pins 10 and 20 at T13 Voltmeter should read 4.8 VDC Remove Molex connector U4 and U5 Check power transistors Q110,Q111,Q210 and Q211 located on headsinks with ohmeter Check diodes CR34 and CR35 located on display PCB Disconnect CRT yoke by removing Molex connector from display PCB Remove CRT socket. Reset breakers Apply AC line power. If unit fails to blow circuit breakers, check all transistors with ohmeter comparing readings between horizontal and vertical sections Check diodes CR12 and CR22 located in vertical drive section Check diodes CR1 and CR11 located in horizontal drive section Check voltage at horizontal and vertical DAC's at pins 13, 14 and 22 Measure outputs of amplifiers U2 and U4 for DC offsets. Signal should be a $\pm$ 2 volts centered around 0 volts Measure outputs of DAC's U5 and U11 Signals should be $\pm$ 4 volts centered around 0 volts
DISPLAY JITTERS	Check vertical size potentiometer R54 for wiper noise by turning R54 briskly while observing screen. Check R54 pins for weak solder connections.

Troubleshooting Chart

PROBLEM	PROBABLE SOLUTIONS
	Check horizontal size potentiometer R60 for wiper noise by turning R60 briskly while observing screen. Check R60 pins for weak solder connections. Check DACs U1 and U5 pins for poor solder connections. Check Molex connector pins for good connections. Check analog switch device U3 for loose pins or poor solder connections on socket. Replace U3.
One-inch Horizontal Line, Displayed on monitor	Check for open power transistors Q110, Q111, Q210 and Q211 using an ohmmeter. Check Molex connector to power transistors for open or weak solder connection.
No Display	Check the neck of CRT for glowing filament. If filament is not glowing, check brown and black twisted wire pair to CRT plug for 6.3 VAC. LED on logic PCB should not be on. Zero scope. Connect scope probe to yellow beam wire at display PCB. Set brightness full clockwise. Data pulses should be 50 volts at an 80-100 VDC base. If no data present, connect scope probe to pin 4 of U6. Then dynamically check Q19 for an open collector to emitter junction (41VDC on emitter). Check Q20 and Q22 with ohmeter. Connect scope probe to the cathode of CR32 and check for a full-wave, unregulated spot kill voltage (approximately 25 volts DC). If not check power supply fuse and check Q14 and Q21. Check 18KV at anode cap of CRT. (Use high voltage probe.) If high voltage not present see No High Voltage remedy. Check CRT neck for broken pins. Check the seating of the CRT plug. -cont'd

Troubleshooting Chart

PROBLEM	PROBABLE SOLUTIONS
NO DISPLAY cont'd	Remove AC line power to game Remove CRT plug from CRT neck Return AC power Measure pin 3 of CRT plug with oscilloscope. Meter should read 400 VDC. Measure pin 4 of CRT plug with oscilloscope. Meter should read 200 VDC. Connect scope probe to yellow beam wire at display PCB. Set intensity control to full clockwise. Data pulses should be 50 volts peak to peak at an 80-100 VDC base. Measure the AC voltage at pins 1 and 8 of the CRT plug. Meter should read 6.3 VAC.
No High Voltage	Measure DC voltage of regulator U12 Meter should read +18 VDC If not present, measure DC voltage at capacitor C25. Meter should read +25 VDC. Measure DC voltage of regulator U9 Meter should read -18 VDC. If not, measure DC voltage at capacitor C17. Voltmeter should read —25 VDC. Lift winding from pin 3 of high voltage transformer T1. Measure +18 voltage regulators If +18 VDC present check Q31 for short Check capacitors C32 and C34 for shorts Check diodes CR46 and CR47 Check 6KV AC on black wire. Check CRT for bent pins
Dot Display	Check analog switch U3 Inspect yoke connector for poor solder connections Check for open yoke winding Measure DC voltage at capacitor C7 Meter should read +25 VDC Measure DC voltage at capacitor C1 Meter should read -25 VDC

Troubleshooting Chart

PROBLEM	PROBABLE SOLUTIONS
Narrow Line Displayed	Check for open yoke winding Check yoke Molex connector for weak or cracked solder connections Check Molex connector continuity to Q110, Q111, Q210 and Q211. Check for open power transistors Q110, Q111, Q210 and Q211
Half Display	
(a) Left Half Missing	Check Q1, Q2 and Q210 with ohmmeter
(b) Right Half Missing	Check Q5, Q11 and Q211 with Ohmmeter
(c) Top Half Missing	Check Q6, Q12 and Q111 with ohmmeter
(d) Bottom Half Missing	Check Q9, Q10 and Q110 with ohmmeter
Brightness Potentiometer has no Control	Check intensity potentiometer R91 wiper Check for open C28 capacitor Check potentiometer pins for weak solder connections
Circuit breakers Blow after warm-up	Measure DC voltage at pins 10 and 20 of device T13 on the logic PCB. Meter should read 4.8 VDC Check for thermally sensitive 723 regulator devices on the power supply Check for thermally sensitive devices on the Logic PCB

Troubleshooting Chart

PROBLEM	PROBABLE SOLUTIONS
	Check for thermal sensitivity of devices U2, U3, U4, U5 and U11 Check operation of DAC U5 Check operation of DAC U11 Check for thermal sensitivity of Q15, Q10, R12 and R39
No Audio	REFER TO PAGES 26 and 27 for Audio Troubleshooting
Does Not Provide Game time When Coin Inserted	Remove AC line power Remove 3-pin Molex connector to coin mechanism Check switch closure with ohmmeter (Center pin of connector is common) Verify one pin normally open and the other normally closed Press coin device at coin mechanism. Pins should change state. Normally open to normally closed and vice versa. Check flip-plop A4 on logic PCB with logic probe on pin 3 of A4. Press coin lever: Pin should change state. With logic probe on pin 6 of A4, press coin lever: pin should change state. Replace device F2 on logic board.
Coin counter does not Work	Check transistor 2N3904 and 2N6292 on logic PCB with ohmmeter Disconnect coin counter Molex connector Measure DC voltage on red wire Meter should read +25 VDC Check power connector (J1) to logic PCB Check electrical connection at pin 3 of J1 (white wire)

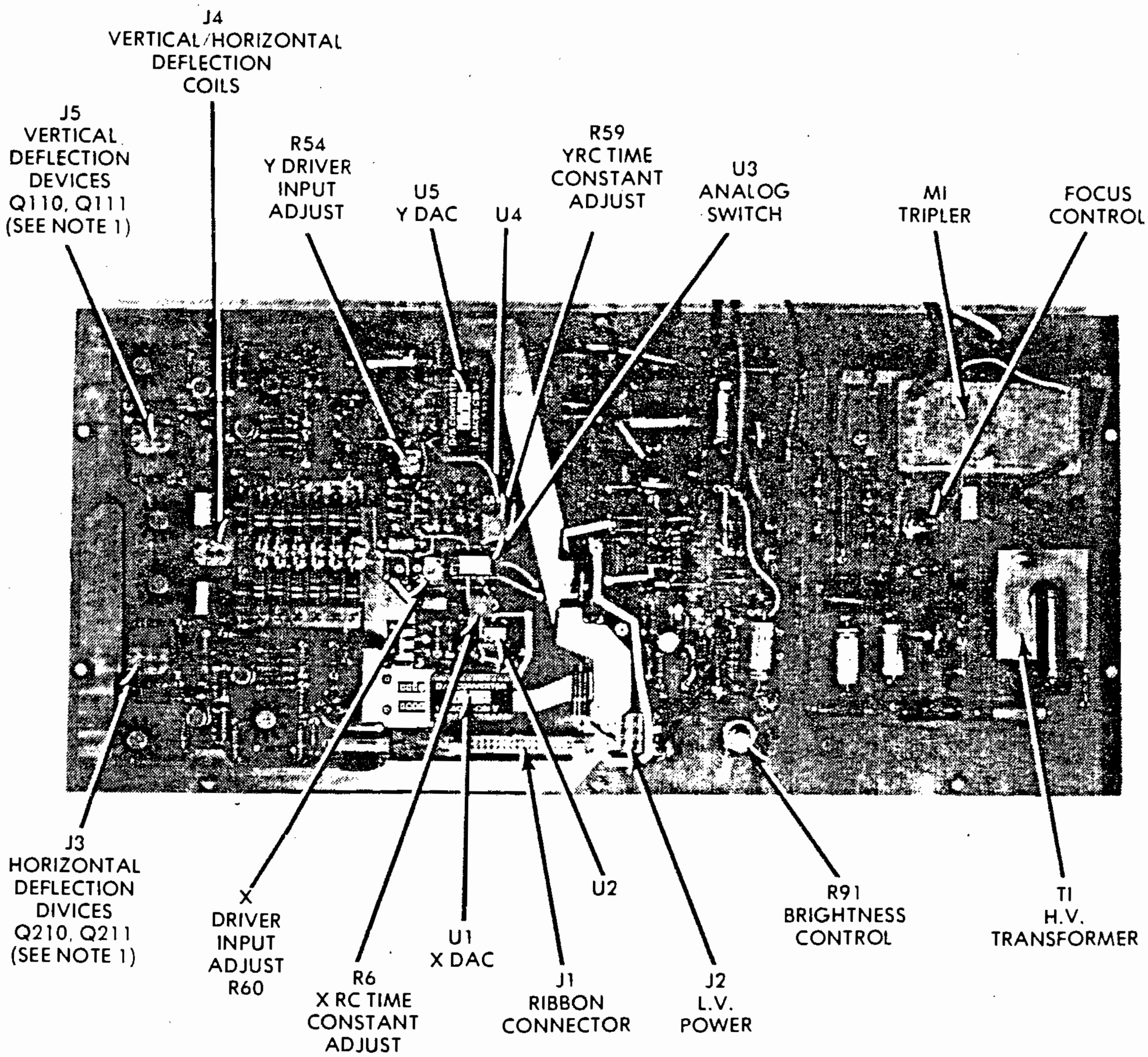
PROBLEM	PROBABLE SOLUTIONS
NO AUDIO	With ohmeter, check for open speaker coil. Verify proper operation of IC10 and IC11, +15 volt and -15 volt regulators Check power transistors Q6 and Q7 with ohmeter. Replace IC19 (TL081) Replace device F2 on logic board (74LS259)
NO SWORD HUM	Jumper pin 1 of IC8 (74LS125) to ground. If sword now present, check continuity between IC8, pin 1 and F2, pin 4 on the logic board. Replace device F2 on logic board. Check transistor Q4 with ohmeter. Verify proper operation of IC13 (CA3080)
NO HIGH LEVEL SWORD HUM	Jumper pin 4 of IC8 to ground. If higher level now present, verify continuity of IC8, pin 4 to F2 pin 5 on logic board. Replace device F2. Check transistor Q3 with ohmeter. Replace IC8.
NO PITFALL AUDIO	Jumper IC8 pin 10 to ground. If audio now present, check continuity between IC8, pin 10 to F2 pin 7 on logic board. Replace device F2. Verify proper operation of IC18 (CA3080) Observe output of oscillator IC16. Pin 6 should be 80% duty cycle, slightly frequency modulated. Check transistor Q5 with ohmeter. Replace IC8.

PROBLEM	PROBABLE SOLUTIONS
PITFALL AUDIO DOES NOT DECAY	Jumper pin 4 of IC14 to ground while observing output of pin 6 with oscilloscope. Pulse should be approximately 15 milliseconds in duration, at 4 VDC. Verify proper operation of IC15 (7406 - open collector)
PITFALL AUDIO DOES NOT WARBLE	Observe pin 3 of IC17 (NE555). Output should be square wave at 14 volt level and 44 millisecond period. Check C32 for open.
NO EXPLOSION, DISTORTED EXPLOSION AUDIO	Verify proper operation of wideband noise generator IC5, IC6, and IC7. Output of IC6 should be random noise signal approximately 1.2 volts peak-to-peak. Output of IC7 should be random noise signal approximately 5.2 volts peak-to-peak. Replace zener diode D1 (IN5220) Attach jumper to IC4 pin 2. Momentarily touch to ground while observing one-shot output pin 3. A single pulse of .6 second duration should occur. Check Q1 with ohmeter. Check capacitor C14. Verify proper operation of IC1 and IC2. Replace device F2 on logic board.
NO REAPPEARANCE HISS	Jumper IC8 pin 13 to ground. If audio now present, check continuity from IC8 pin 13 to F2 pin 9 on logic board. Replace device F2 on logic board. Check transistor Q2. Verify proper operation of device IC3. Replace IC8. Verify proper operation of wideband noise generator IC5, IC6, and IC7. Output of IC6 should be random noise signal approximately 1.2 volts peak-to-peak. Output of ICs should be random noise signal approximately 5.2 volts peak-to-peak.

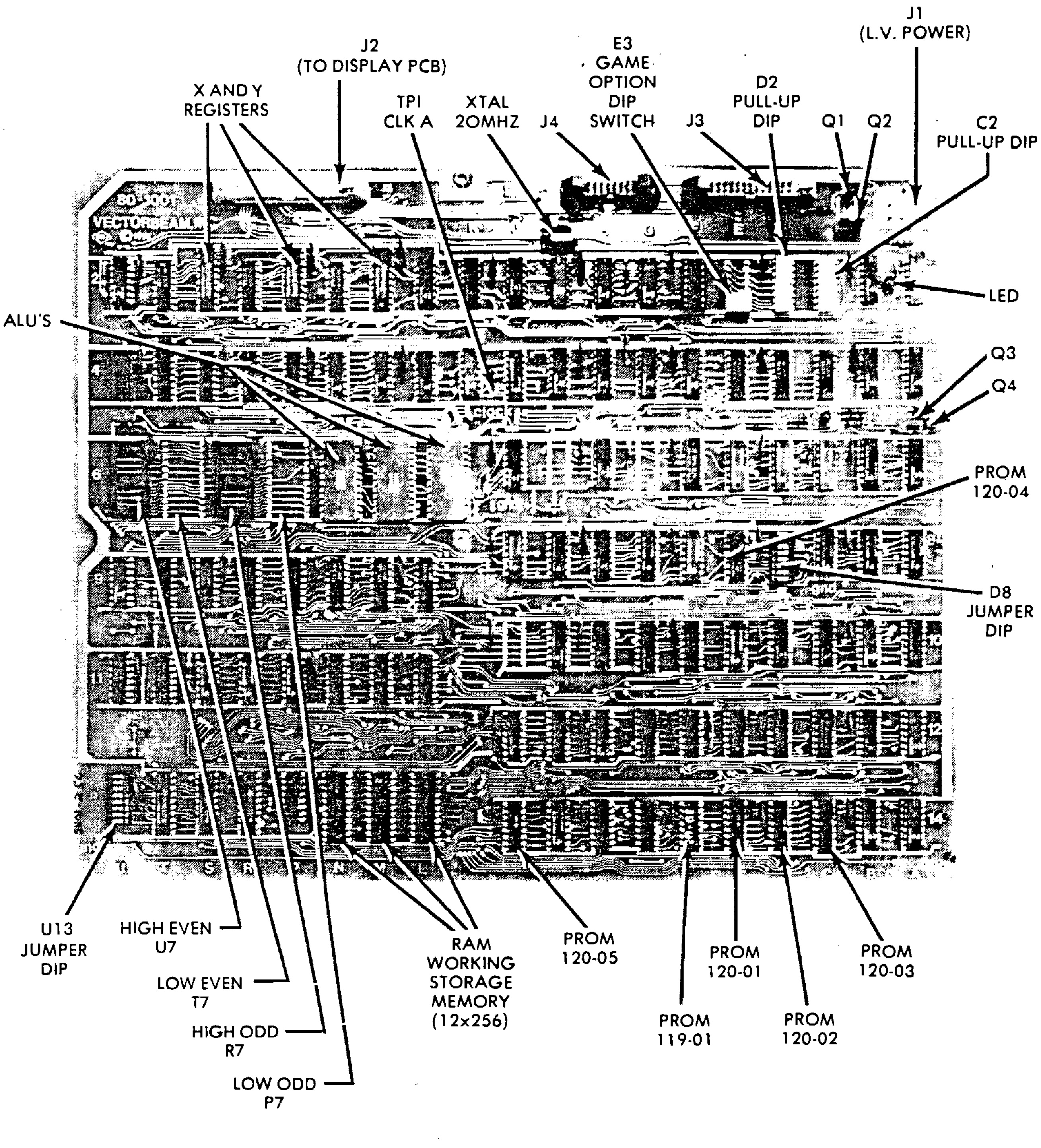
SUGGESTED PARTS FOR STOCK

Due to the fact that the VECTORBEAM^{tm} system is a new type of display technology, there are a number of components used which may have limited availability from your local parts suppliers. It is suggested that the following list of parts be purchased in the even servicing of your game becomes necessary:

1. TL182 - Analog Switch
2. TL081 - Op-Amp
3. 7918 - Regulator IC
4. 7915 - Regulator IC
5. 7818 - Regulator IC
6. 7815 - Regulator IC
7. LF13331 - High Speed Analog Switch
8. DAC-80 - Digital to Analog Convertor
9. 741s259 - IC (Texas Insutruments only)
10. 74LS32 - IC
11. Set D-ROMS (1-6)



Display Monitor PCB
Testpoint and Adjustment Layout

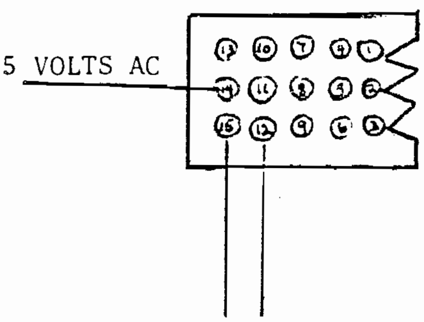


Logic PCB
Testpoint and Adjustment Layout

POWER IN - THE POWER SUPPLY OPERATES AT 100, 115 OR 230 VOLTS 50 - 60 Hz., AS DETERMINED BY JUMPERS ON THE TRANSFORMER (SEE JUMPER SCHEDULE ON POWER SUPPLY)



LAMPS - TWO 115 VOLT AC LINES, BLACK AND WHITE TWISTED PAIRS ARE PROVIDED FOR AT THE POWER SUPPLY TO POWER LAMPS IN THE CABINET. THE AVAILABLE VOLTAGE 115 VOLTS IS INDEPENDENT OF THE SUPPLY INPUT VOLTAGE. WHEN OPERATING AT 230 VOLTS 230 VOLTS IS AVAILABLE BETWEEN PINS 12 AND 13.

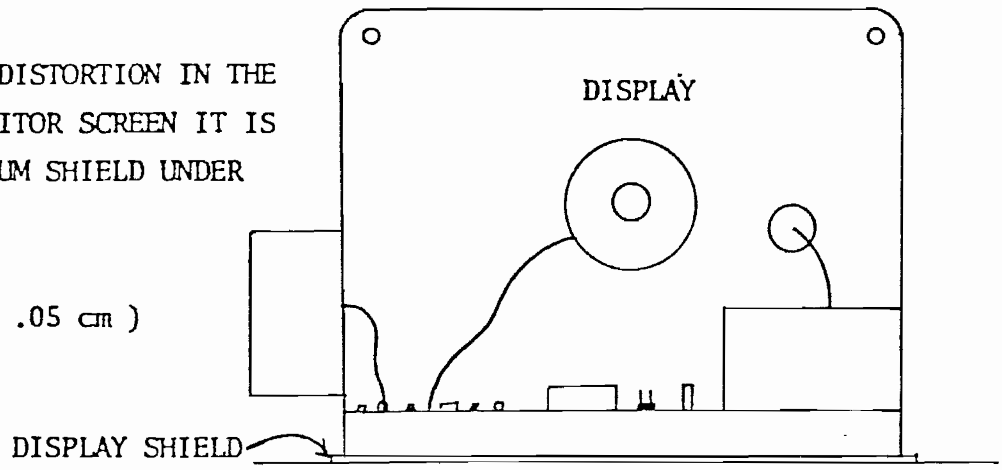


POWER SUPPLY PIN DIAGRAM

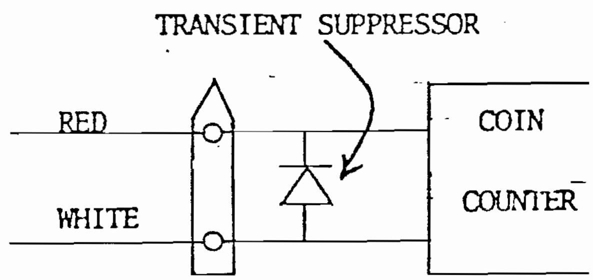
DISPLAY SHIELD - TO PREVENT DISTORTION IN THE OBJECTS DISPLAYED ON THE MONITOR SCREEN IT IS NECESSARY TO PLACE AN ALUMINUM SHIELD UNDER THE DISPLAY UNIT.

SIZE: 17 ½ " x 8 ½ " x .02 "

(44.5 cm x 21.5 cm x .05 cm)

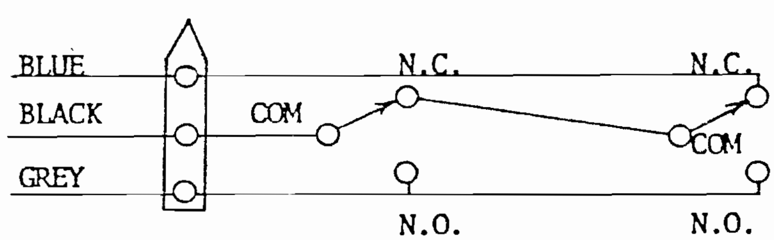


COIN COUNTER - USE A 24 VOLT DC COUNTER. A TRANSIENT SUPPRESSOR DIODE (1N4003 OR EQUIVALENT) MUST BE CONNECTED ACROSS THE INPUT TO THE COUNTER.



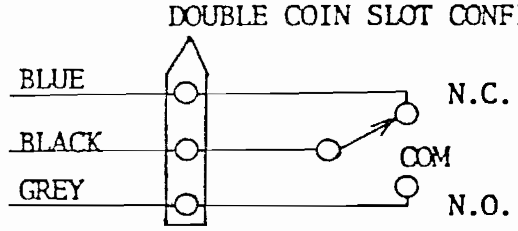
SPEAKER - USE AN 8 OHM, 20 WATT, 8 INCH SPEAKER. THE SPEAKER MUST HAVE A GOOD LOW FREQUENCY RESPONSE.

COIN SWITCH - A SPDT SWITCH MUST BE USED TO SENSE THE COINS.



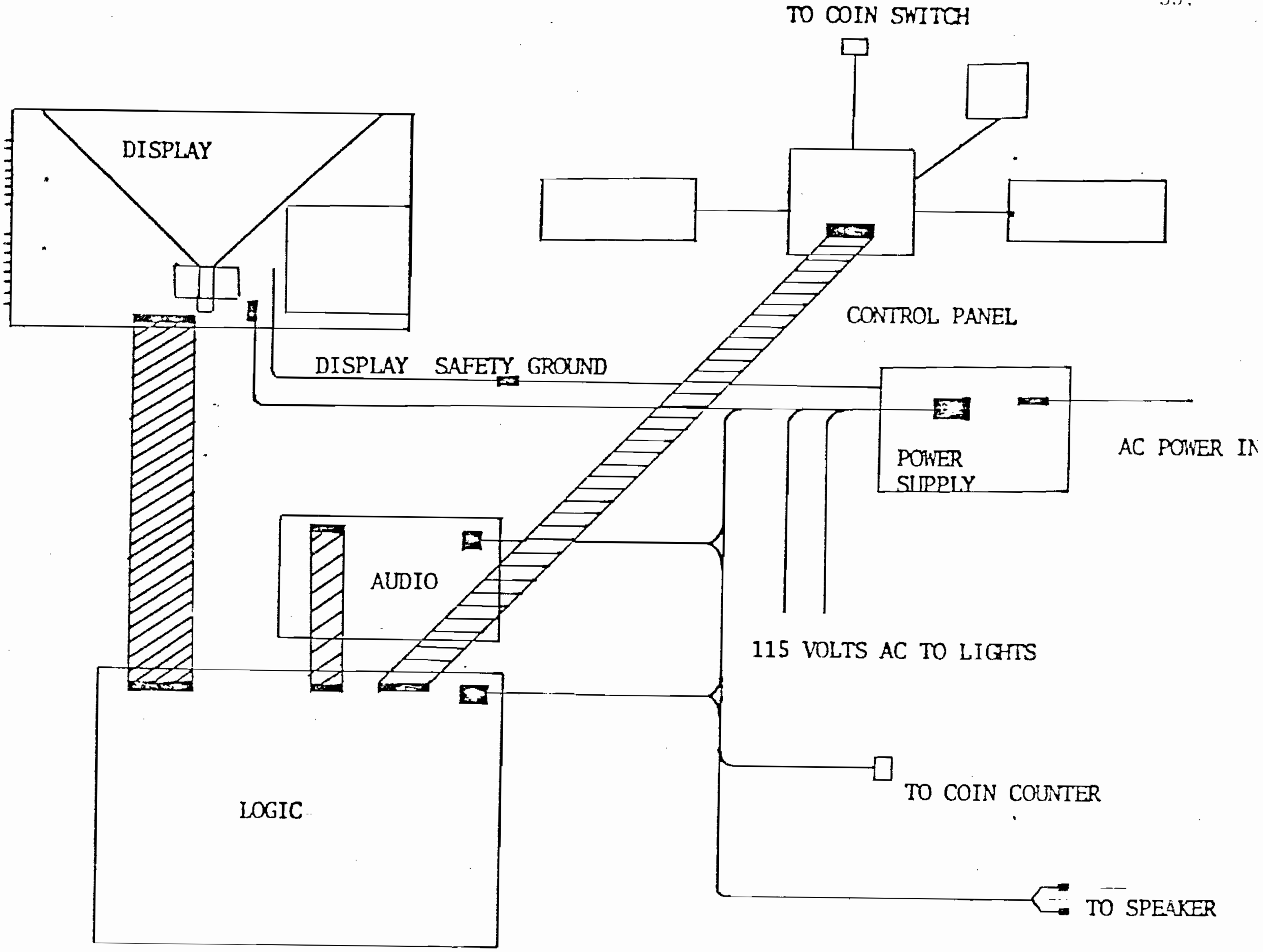
DOUBLE COIN SLOT CONFIGURATION

... MMON
N.C. - NORMALLY CLOSED
N.O. - NORMALLY OPEN



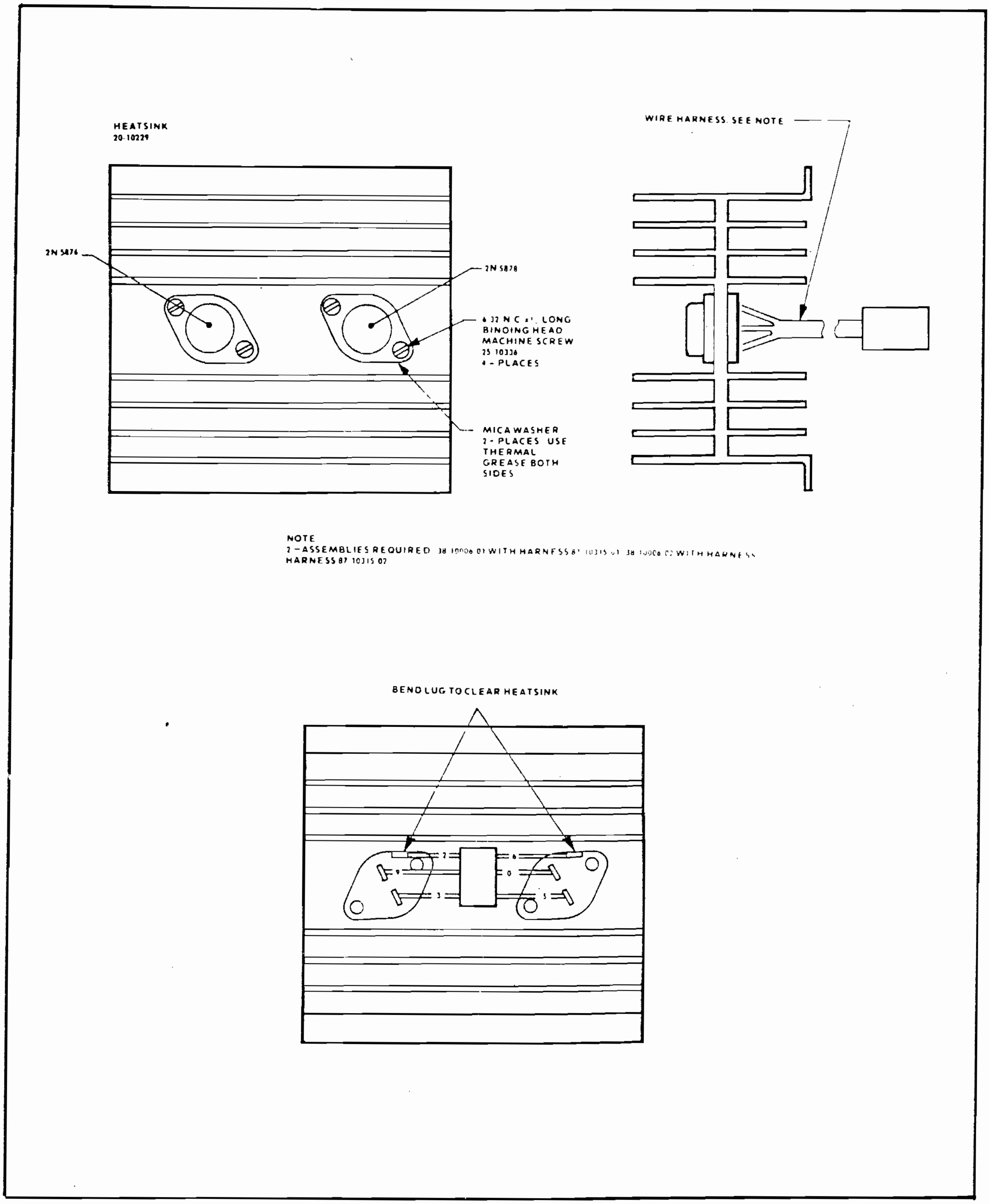
SINGLE COIN SLOT CONFIGURATION

INTERCONNECT DIAGRAM

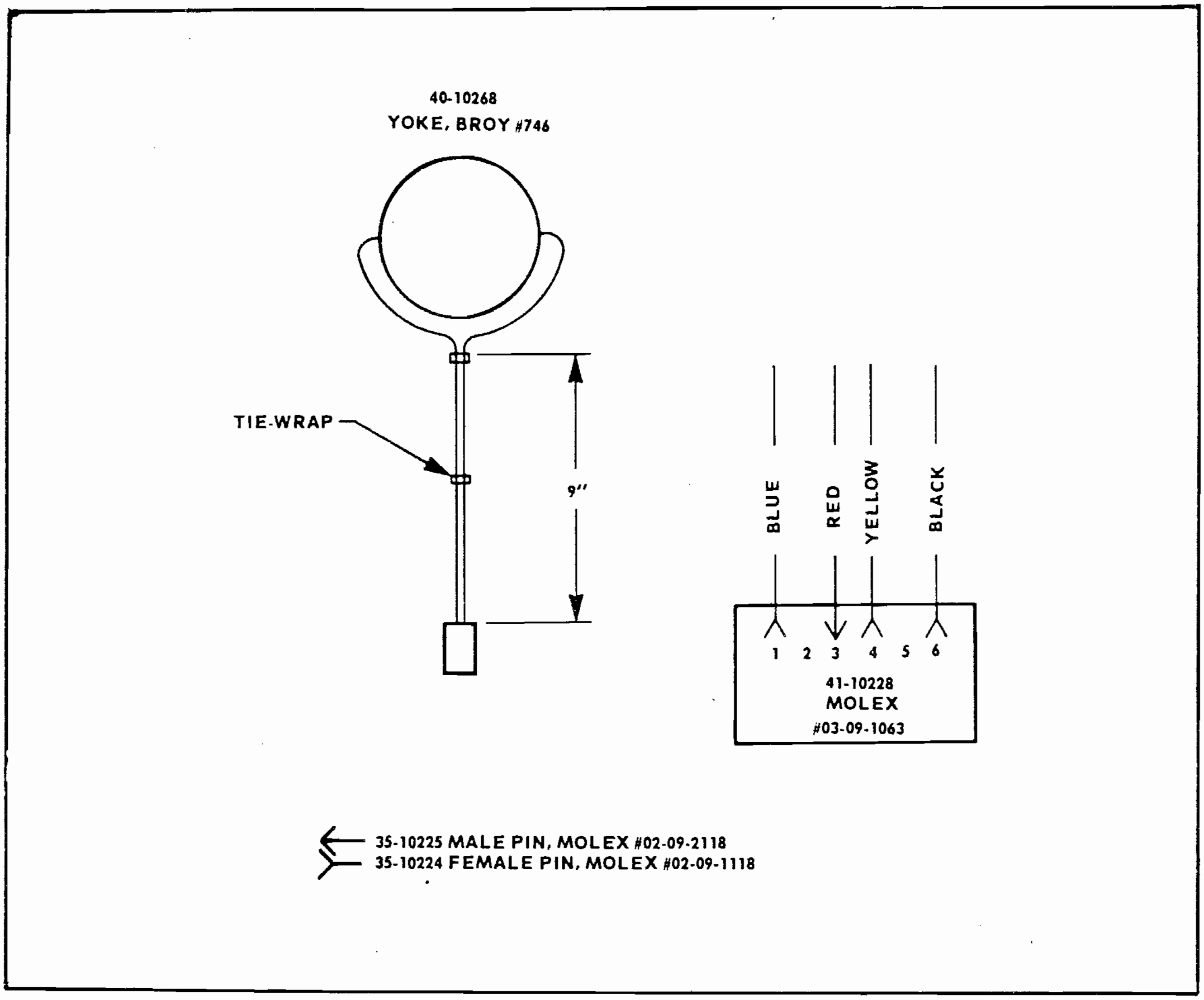


CAUTION WARNING IMPORTANT ---- CONNECT DISPLAY SAFETY GROUND BEFORE CONNECTING OR DISCONNECTING POWER SUPPLY OR LOGIC BOARD TO OR FROM THE DISPLAY UNIT

DO NOT CONNECT OR DISCONNECT ANY RIBBON CABLES OR POWER CONNECTORS WITH THE AC POWER APPLIED



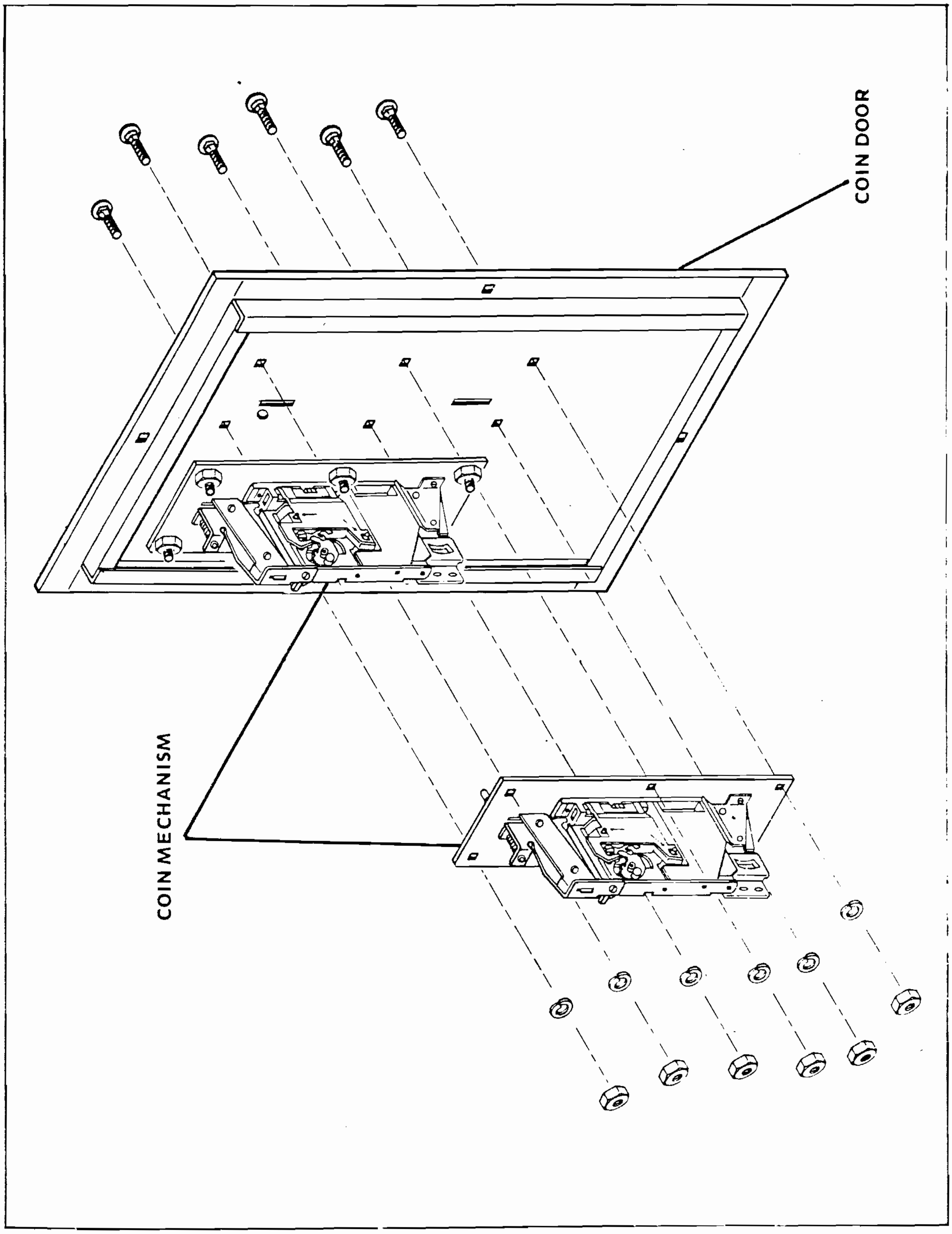
Heat Sink Assembly



Yoke Assembly

Yoke Assembly
Parts List
38-10344-01 Rev. A

ITEM	PART NUMBER	DESCRIPTION
	35-10224-01	Pin, Female, Molex 02-09-1118
	35-10225-01	Pin, Male, Molex 02-09-2118
	40-10268-01	Yoke, Broy 746
	41-10228-01	Con, Molex 03-09-1063, 6 Pin Recept



Coin Mechanism Assembly

Speaker Assembly
Parts List
38-01422-01 Rev. A

ITEM	PART NUMBER	DESCRIPTION
1	20-10293-01	Fab speaker grill
2	21-10269-02	Fab gasket, speaker 9 1/4"x 9 1/4"
3	21-10420-01	Fab gasket speaker 8" (round) x 1/4"
4	25-10449-01	xxx pop rivet #AD410ABS
5	25-10450-01	xxx rivet washer flat #SBUP 1/8
6	71-10109-01	xxx speaker Becker 908A237

Coin Meter Assembly
Parts List
38-10008-01

ITEM	PART NUMBER	DESCRIPTION
1	29-10218-01	xxx coin meter E607B-10DC24
2	35-10224-01	pin pin, female, Molex 02-09-1118
3	41-10219-01	con con, Molex 03-09-2038, 3 pin plug
4	65-10027-01	DIO rectifier, 1 amp, 1N4003

Coin Door Assembly
Parts List
3810008-01

ITEM	PART NUMBER	DESCRIPTION
1.	20-10338-01	Fab coin door
2.	25-10227-01	xxx cable tie, nylon 4 In.
3.	25-10270-02	xxx ock, coin door fort #N5078AR403KD
4.	25-10406-01	wsh #10 flat washer plated zinc
5.	25-10407-01	wsh #10 lock washer plated zinc
6.	25-10411-01	nut hex nut 10-24 plated zinc
7.	25-10437-01	xxx tie mount TM 3525 (PANDUIT)
8.	26-10448-01	xxx coin accecptor, #2608-3000-5 with front plate
9.	87-10342-01	asy harness, coin door

Heat Sink Assembly (Front)
Parts List
38-10006-01 Rev. B

ITEM	PART NUMBER	DESCRIPTION
1	09-10337-01	Heatsink Compound, Wakefield #120
2	20-10229-01	Heatsink (2107)
3	25-10336-01	Screw, Mach. #6-32 x ½ Binding Hd.
4	66-10018-01	Transistor, PNP 2N5876
5	66-10019-01	Trnasistor, NPN 2N5878
6	87-10315-01	Harness Assembly, Front (for heatsink)

Heat Sink Assembly (Rear)
Parts List
38-10006-01 Rev. B

ITEM	PART NUMBER	DESCRIPTION
1	09-10337-01	Heatsink Compound, Wakefield #120
2	20-10229-01	Heatsink (2107)
3	25-10336-01	Screw, Mach. #6-32 x ½ Binding Hd.
4	66-10018-01	Transistor, PNP 2N5876
5	66-10019-01	Transistor, NPN 2N5878
6	87-10315-02	Harness Assembly, Rear (for Heatsink)

Display Assembly
Parts List
38-10003-01

ITEM	PART NUMBER	DESCRIPTION
1	20-10256-01	Chassis, Display
2	20-10260-01	High Voltage Cage (2105A)
3	20-10261-01	Tube Mounting Bracket, L.H. (2169)
4	20-10262-01	Tube Mounting Bracket, R.H. (2170)
5	22-10233-01	Lable, 'Do Not Operate Warning' (2134)
6	22-10251-01	Lable, 'High Voltage' (2136)
7	22-10252-01	Lable, 'Factory Adjustment Only' (2137)
8	25-10187-01	Nut, Hex #6-32
9	25-10203-01	Screw, Sheet Metal #6 x 3/8 Hex, Type B
10	25-10206-01	Screw, Sheet Metal #10 x ½ Hex, Type A
11	25-10209-01	Lockwasher, Internal #6
12	25-10263-01	Washer, Flat #10
13	25-10264-01	Washer, Fender 3/16 Medium Wide, 1 IN. O.D.
14	25-10265-01	Spring, Century Spring #171C
15	25-10341-01	Washer, Flat #6 3/8" O.D. Waldom #MW-402
16	25-10343-01	Screw, Machine, 6-32 x 3/8, PH PH
17	38-10006-01	Heatsink Assembly - Front
18	38-10006-02	Heatsink Assembly - Rear
19	38-10007-01	Display Board Assembly
20	38-10344-01	Yoke Assembly
21	90-10266-01	Lube, Cathode Ray 19" 19-VARP4

Logic PCB Assembly
Parts List
38-10001-01 Rev. F

ITEM	PART NUMBER	DESCRIPTION
1	35-10179-01	Test Points
2	36-10175-01	Socket, 16 PIN I.C. DIP
3	36-10176-01	Socket, Amp 16 Jumper
4	36-10395-01	Socket, 24 PIN
5	37-10178-01	Switch, 2 Pole Dip
6	41-10160-01	Con, Molex 09-18-5127, 12 PIN PC, F4
7	41-10161-01	Con, 34 PIN, 3M#3431-2202
8	41-10162-01	Con, 16 PIN, 3M#3408-2202
9	41-10163-01	Con, 26 PIN, 3M#3429-2202
10	44-01001-01	IC, ROM (1001)
11	44-01002-01	IC, ROM (1002)
12	44-10110-01	IC, 74S00
13	44-10111-01	IC, 74S02
14	44-10112-01	IC, 74S04
15	44-10113-01	IC, 74S08
16	44-10114-01	IC, 74S10
17	44-10115-01	IC, 74S32
18	44-10116-01	IC, 74S113
19	44-10117-01	IC, 74S158
20	44-10118-01	IC, 74S182
21	44-10119-01	IC, 74S288 PROM, DROM, 1
22	44-10120-01	IC, 74S288 PROM, DROM, 2
23	44-10120-02	IC, 74S288 PROM, DROM, 3
24	44-10120-03	IC, 74S288 PROM, DROM, 4
25	44-10120-04	IC, 74S288 PROM, DROM, 5
26	44-10120-05	IC, 74S288 PROM, DROM, 6
27	44-10121-01	IC, 74LS00
28	44-10122-01	IC, 74LS02
29	44-10123-01	IC, 74LS04
30	44-10124-01	IC, 74LS08
31	44-10125-01	IC, 74LS10
32	44-10126-01	IC, 74LS27
33	44-10127-01	IC, 74LS32
34	44-10128-01	IC, 74LS75
35	44-10129-01	IC, 74LS85
36	44-10130-01	IC, 74LS86
37	44-10131-01	IC, 74LS107
38	44-10132-01	IC, 74LS151
39	44-10133-01	IC, 74LS157
40	44-10134-01	IC, 74LS163
41	44-10135-01	IC, 74LS164
42	44-10136-01	IC, 74LS194
43	44-10137-01	IC, 74LS259
44	44-10138-01	IC, 74LS298

Logic PCB Assembly
Parts List
38-10001-01 Rev F

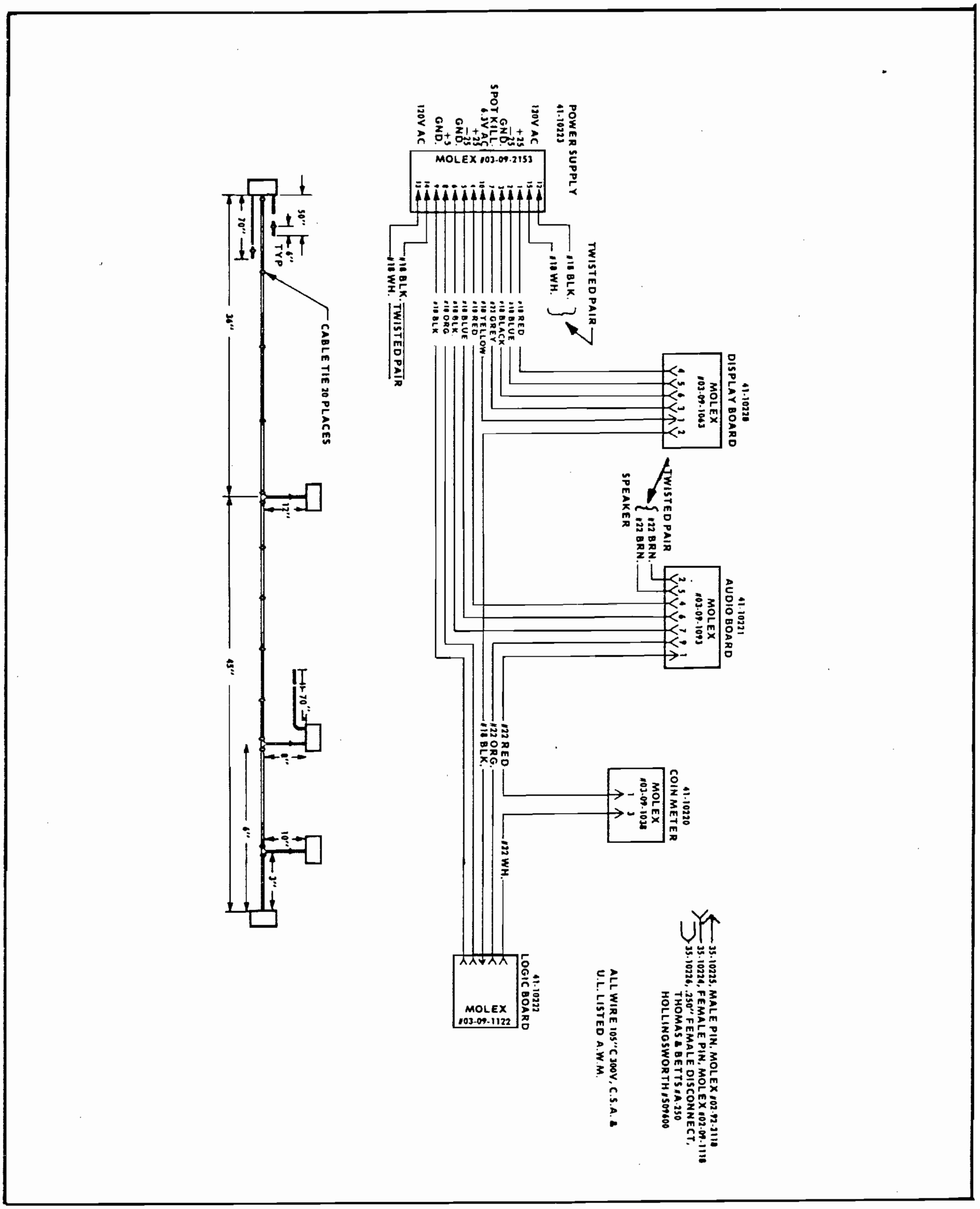
ITEM	PART NUMBER	DESCRIPTION
45	44-10139-01	IC, 74LS377
46	44-10140-01	IC, 74LS393
47	44-10141-01	IC, 25LS818
48	44-10142-01	IC, 2101A-2
49	44-10144-01	IC, 7425
50	44-10150-01	IC, 74265
51	44-10340-01	IC, 74LS257
52	53-10054-01	Res, CC, ¼W, 5% 100 OHM
53	53-10058-01	Res, CC, ¼W, 5% 330 OHM
54	53-10059-01	Res, CC, ¼W, 5% 470 OHM
55	53-10062-01	Res, CC, ¼W, 5% 1 K
56	53-10064-01	Res, CC, ¼W, 5% 2.2 K
57	53-10066-01	Res, CC, ¼W, 5% 4.7 K
58	53-10070-01	Res, CC, ¼W, 5% 10 K
59	53-10072-01	Res, CC, ¼W, 5% 20 K
60	53-10073-01	Res, CC, ¼W, 5% 30 K
61	53-10080-01	Res, CC, ¼W, 5% 560 K
62	53-10099-01	Res, PACK, IK D-16-15-2-1K
63	63-10030-01	CAP, TANT, DIP, 25/35V, 3.3MF
	63-10031-01	CAP, TANT, DIP, 35V, 33MF
	63-10040-01	CAP, DISC, 50V, .02MF
	63-10042-01	CAP, DISC, 100V, 680PF
	65-10026-01	DIODE, SI, SIGNAL 1N914B
	65-10177-01	LED, TIL220
	66-10011-01	TRANSISTOR, NPN 2N3904
	66-10012-01	TRANSISTOR, NPN 2N6292
	69-10214-01	CRYSTAL, 20 MHZ
	80-01001-01	Logic Board

Display PCB Assembly
Parts List
38-10007-01 Rev. H

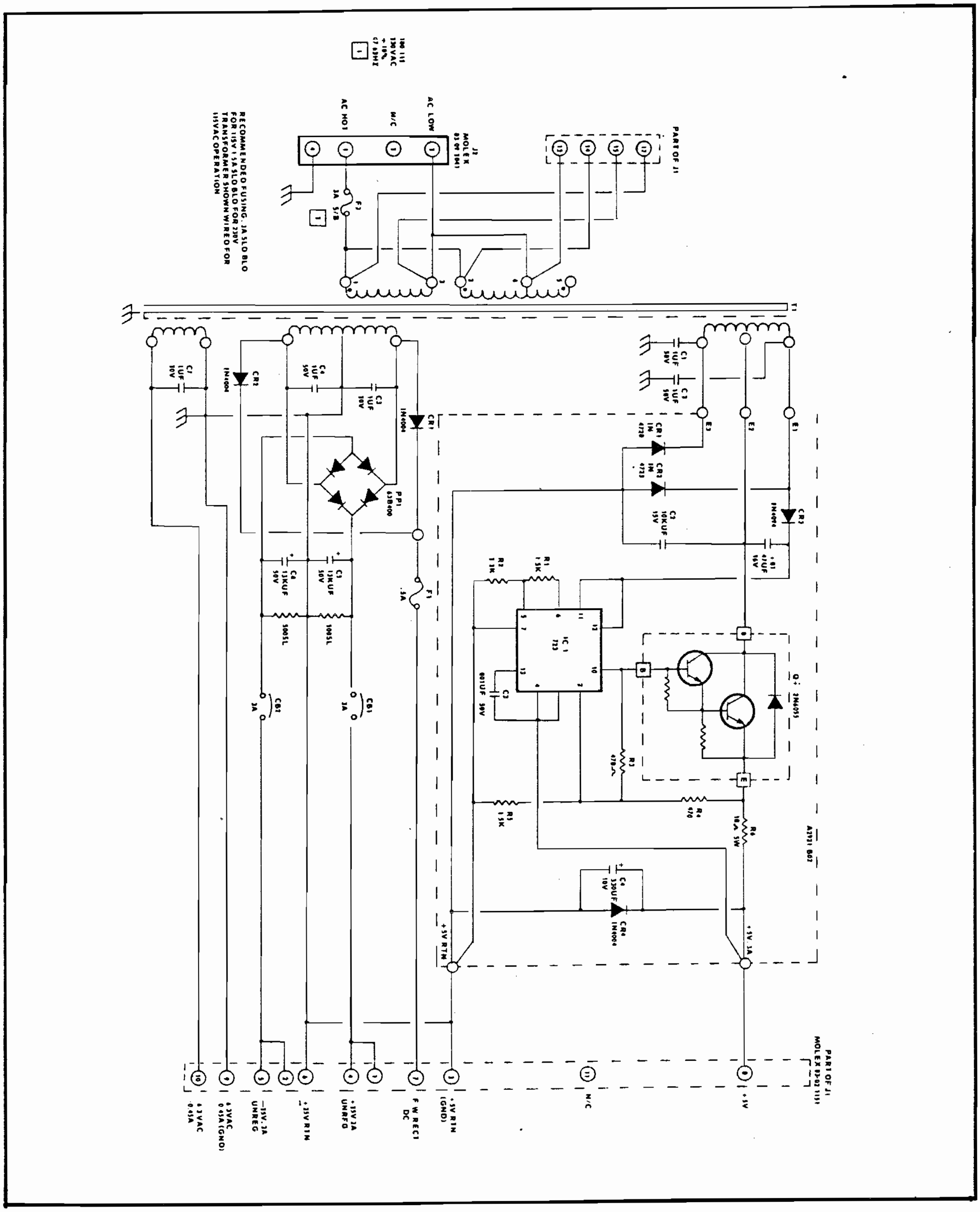
ITEM	PART NUMBER	DESCRIPTION
1	20-10170-01	Heatsink 6070B
2	20-10393-01	Heatsink Wakefield 204AB
3	25-10187-01	Nut, Hex #6-32
4	25-10192-01	Nut, Hex #4-40
5	25-10195-01	Screw, Mach. #4-40 x 3/8, PH PH
6	25-10208-01	Lockwasher, STD. #4
7	25-10209-01	Lockwasher, International #6
8	25-10336-01	Screw, Mach. #6-32 x ½ Binding Hd.
9	36-10174-01	Socket, CRT
10	36-10175-01	Socket, 16 Pin I.C. DIP
11	40-10173-01	Tripler, Varo MH919
12	41-10156-01	Con, Molex 09-18-5960, 6 Pin PC, F3
13	41-10157-01	Con, Molex 09-18-5062, 6 Pin PC, F5
14	41-10158-01	Con, Molex 09-18-5069, 6 Pin PC, F1
15	41-10161-01	Con, 34 Pin, 3M #3431-2202
16	43-10171-01	Choke, 100 Microhenry
17	43-10172-01	Transformer, High Voltage HV18
18	44-10143-01	IC, 7406
19	44-10145-01	IC, 7805
20	44-10146-01	IC, 7815
21	44-10147-01	IC, 7818
22	44-10148-01	IC, 7915
23	44-10149-01	IC, 7918
24	44-10152-01	IC, TL081
25	44-10154-01	IC, DAC80 D/A Converter
26	44-10155-01	IC, LF13331 Analog Switch
27	51-10105-01	Pot, 10K A-B #JA1N056S103UA
28	51-10106-01	Pot, 1 Meg A-B #JA1N056S105UA
29	51-10107-01	Trimpot, 100 OHM Bourne 3352P1
30	51-10108-01	Trimpot, 5 K Bourne 3352P2
31	53-10051-01	Res, CC, ¼W, 5% 15 OHM
32	53-10052-01	Res, CC, ¼W, Zi-CHM
33	53-10053-01	Res, CC, ¼W, 5% 47 OHM
34	53-10054-01	Res, CC, ¼W, 5% 100 OHM
35	53-10057-01	Res, CC, ¼W, 5% 200 OHM
36	53-10058-01	Res, CC, ¼W, 5% 330 OHM
37	53-10059-01	Res, CC, ¼W, 5% 470 OHM
38	53-10061-01	Res, CC, ¼W, 5% 820 OHM
39	53-10062-01	Res, CC, ¼W, 5% 1 K
40	53-10063-01	Res, CC, ¼W, 5% 1.8 K
41	53-10064-01	Res, CC, ¼W, 5% 2.2 K
42	53-10065-01	Res, CC, ¼W, 5% 3 K
43	53-10066-01	Res, CC, ¼W, 5% 4.7 K
44	53-10067-01	Res, CC, ¼W, 5% 5.6 K
45	53-10070-01	Res, CC, ¼W, 5% 10 K

Display PCB Assembly
Parts List
38-10007-01 Rev H

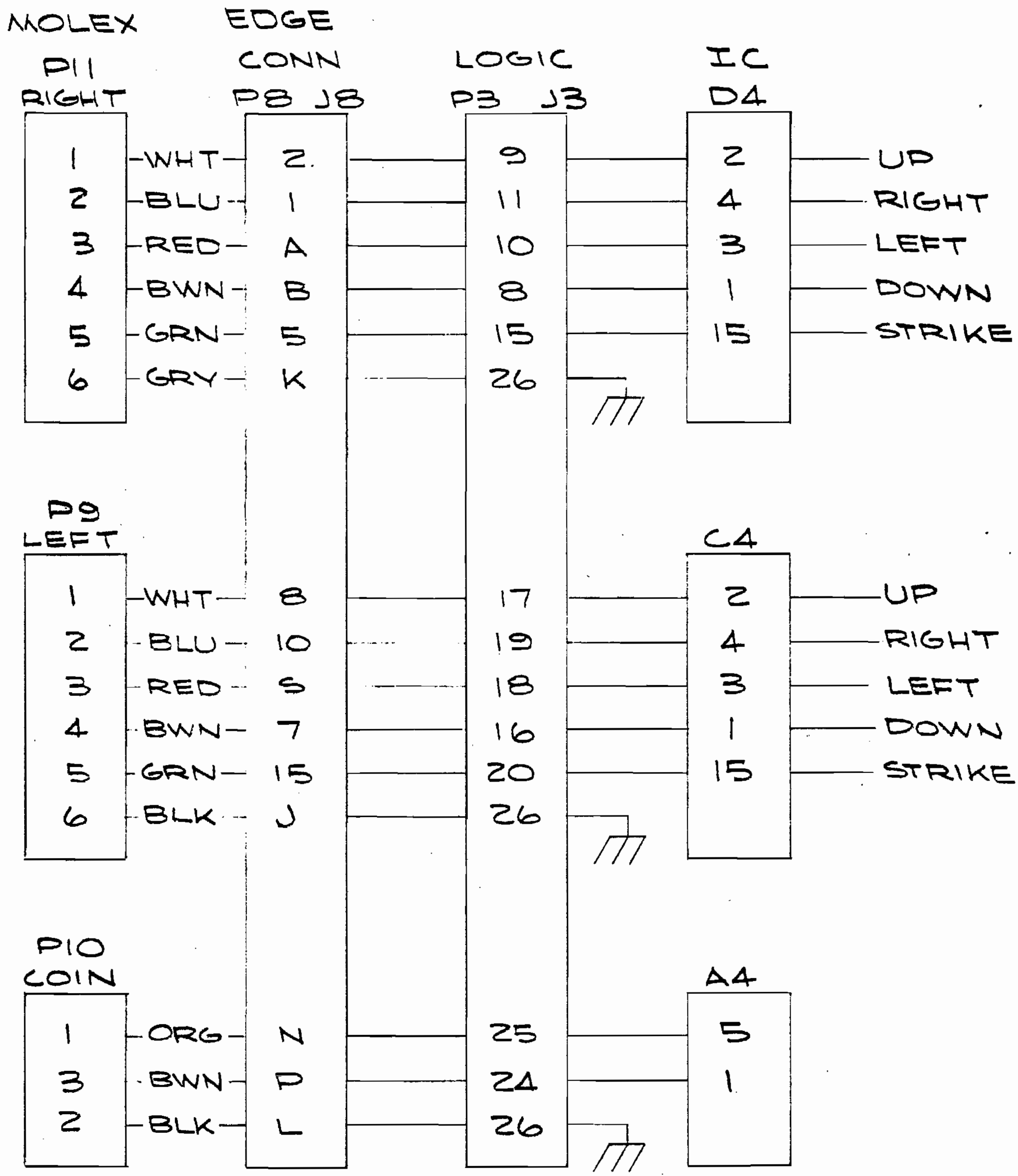
ITEM	PART NUMBER	DESCRIPTION
46	53-10076-01	Res, CC, ¼W, 5% 68 K
47	53-10083-01	Res, CC, ½W, 5% 1.2 K
48	53-10084-01	Res, CC, ½W, 5% 2.2 K
49	53-10085-01	Res, CC, ½W, 5% 8.2 K
50	53-10086-01	Res, CC, ½W, 5% 10 K
51	53-10087-01	Res, CC, ½W, 5% 510 K
52	53-10088-01	Res, CC, ½W, 5% 4.7 MEG
53	53-10089-01	Res, CC, 1W, 5% 2.7 OHM
54	53-10091-01	Res, CC, 1W, 5% 360 OHM
55	53-10092-01	Res, CC, 1W, 5% 10 K
56	53-10093-01	Res, WW, 8W 150 OHM, OHMITE TYPE 200
57	53-10095-01	Res, WW, 8W 500 OHM, OHMITE TYPE 200
58	53-10096-01	Res, Metal Film, 1% 1.43 K, RN55D
59	53-10097-01	Res, Metal Film, 1% 2.1 K, RN55D
60	53-10098-01	Res, Metal Film, 1% 10 K, RN55D
61	53-10101-01	Res, CC, ½W, 5% 47 OHM
62	53-10102-01	Res, CC, 2W, 5% 100 OHM
63	53-10379-01	Res, WW, 2W, 22 OHM DALE RS2B
64	63-10029-01	CAP, 50V, 50MF, Sprangue TE1307
65	63-10033-01	CAP, TANT, DIP, 50V, 2.2MF
66	63-10034-01	CAP, TANT, DIP, 35V, 4.7MF
67	63-10041-01	CAP, DIST, 100V, .1MF
68	63-10043-01	CAP, 100V, 5MF
	63-10044-01	CAP, ALUM, AXIAL LEAD, 100V, 10MF
	63-10045-01	CAP, ALUM, AXIAL LEAD, 150V, 10MF
	63-10048-01	CAP, Polycarbonate, 200V .022MF
	63-10049-01	CAP, 250V, .068MF PLESSEY
	63-10050-01	CAP, 100V, .1MF PLESSEY
	63-10215-01	CAP, DISC, 100V, .005MF
	63-10380-01	CAP, TABULAR .1MF 600V Sprague 6PS-P10
	65-10024-01	Rectifier, FR MR818
	65-10025-01	Diode, High Volt, MR250-2
	65-10026-01	Diode, SI, SIGNAL 1N914B
	65-10027-01	Rectifier, 1 AMP, 1N4003
	66-10011-01	Transistor, NPN 2N3904
	66-10013-01	Transistor, NPN 2N2102
	66-10014-01	Transistor, NPN 2N5210
	66-10015-01	Transistor, NPN 2N5320
	66-10016-01	Transistor, PNP 2N5322
	66-10017-01	Transistor, NPN 2N5550
	66-10021-01	Transistor, PNP 2N3906
	66-10023-01	Transistor, NPN TIP41C
	80-02001-01	Display Board
	87-10382-01	Ground Wire Assy - Display Board



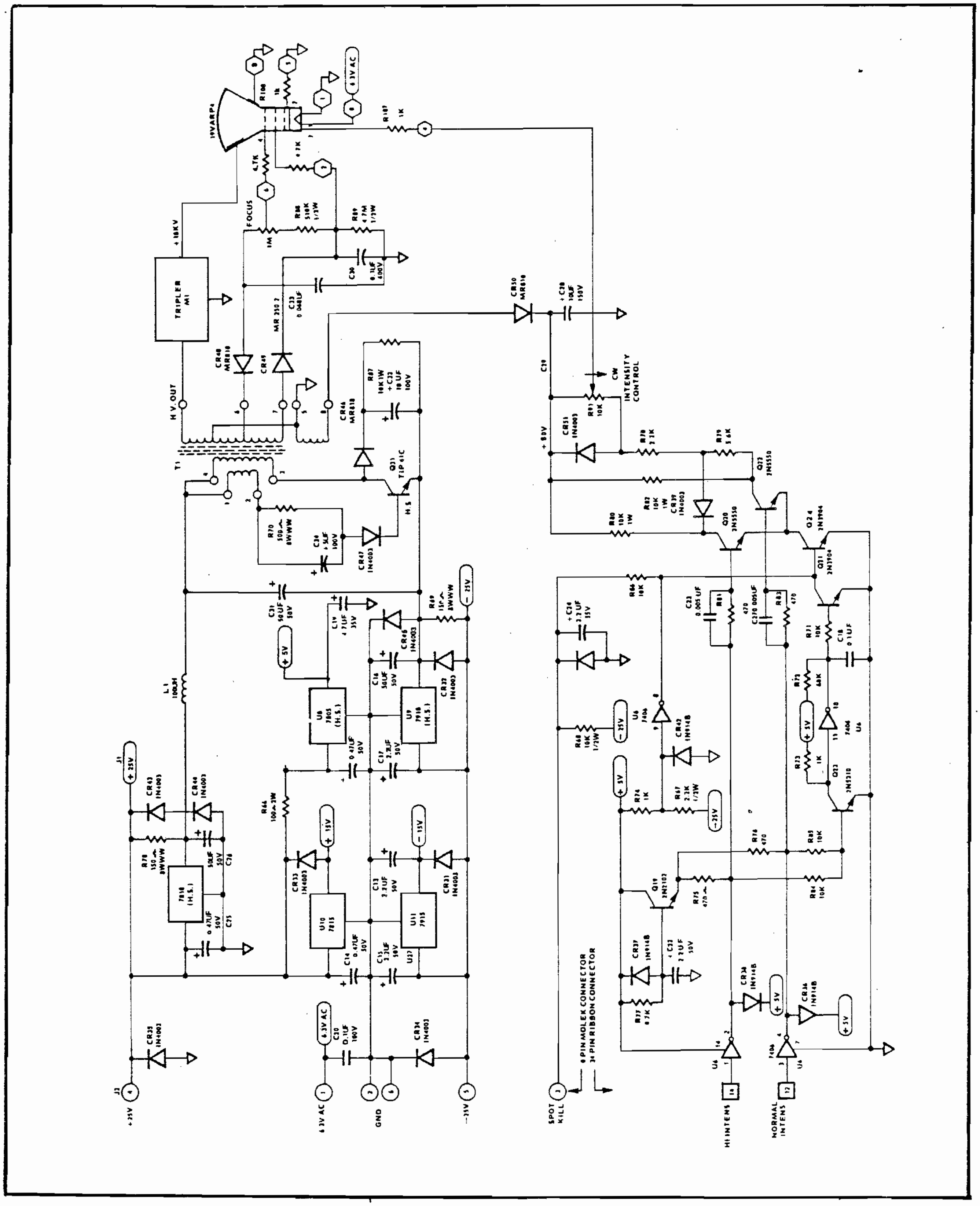
Power Harness



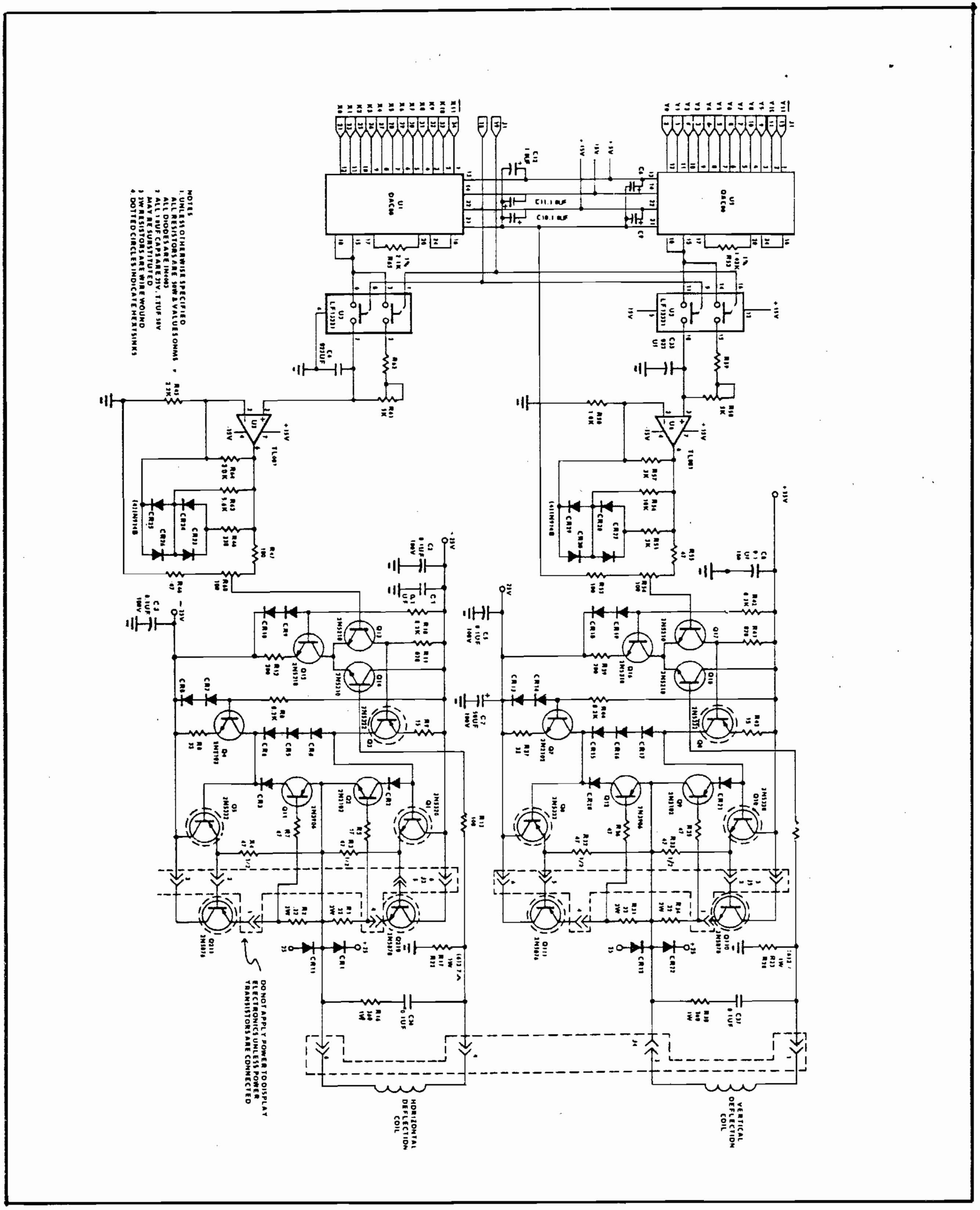
Power Supply Schematic



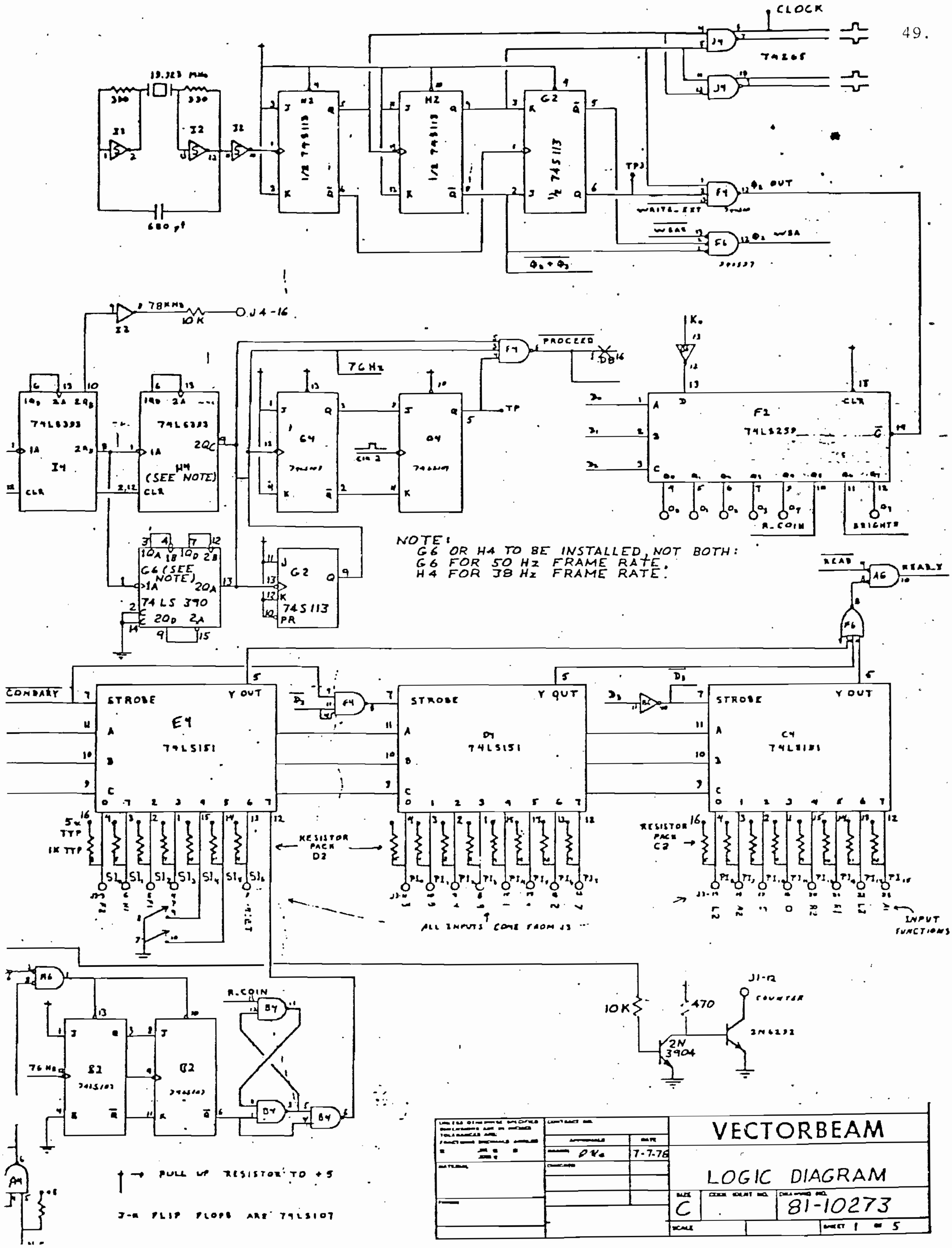
CONTROL INTERCONNECT
DIAGRAM

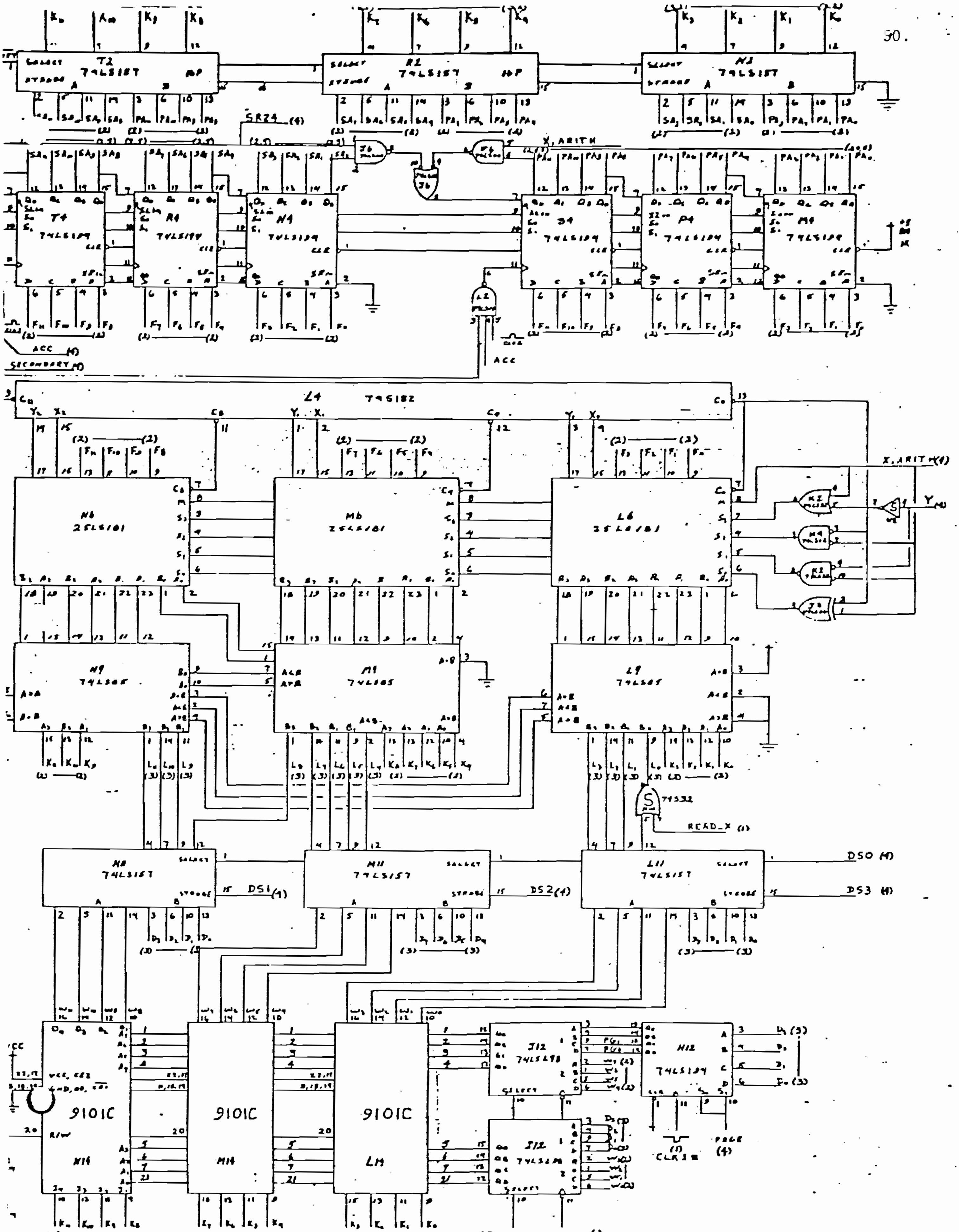


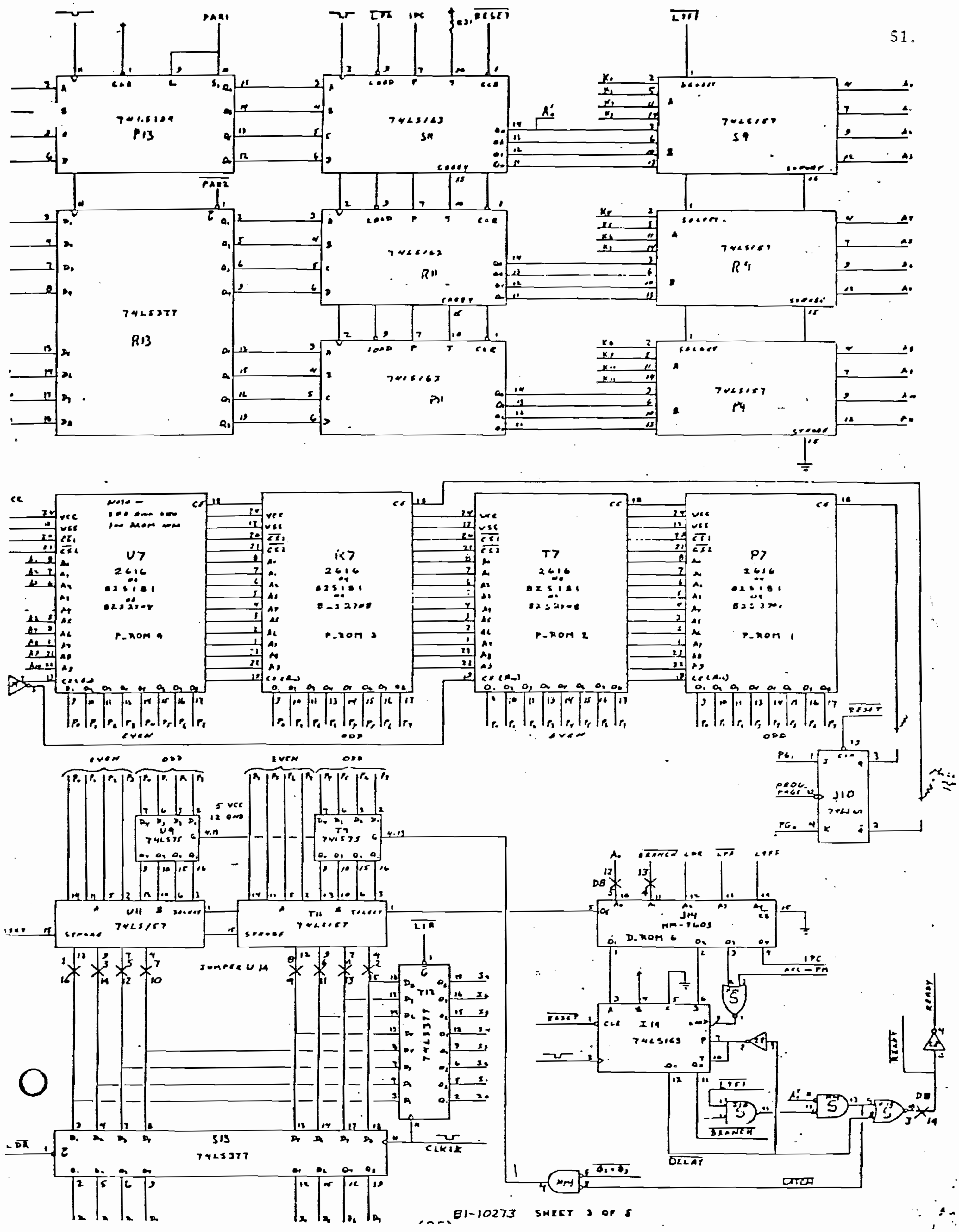
Monitor Display Electronics



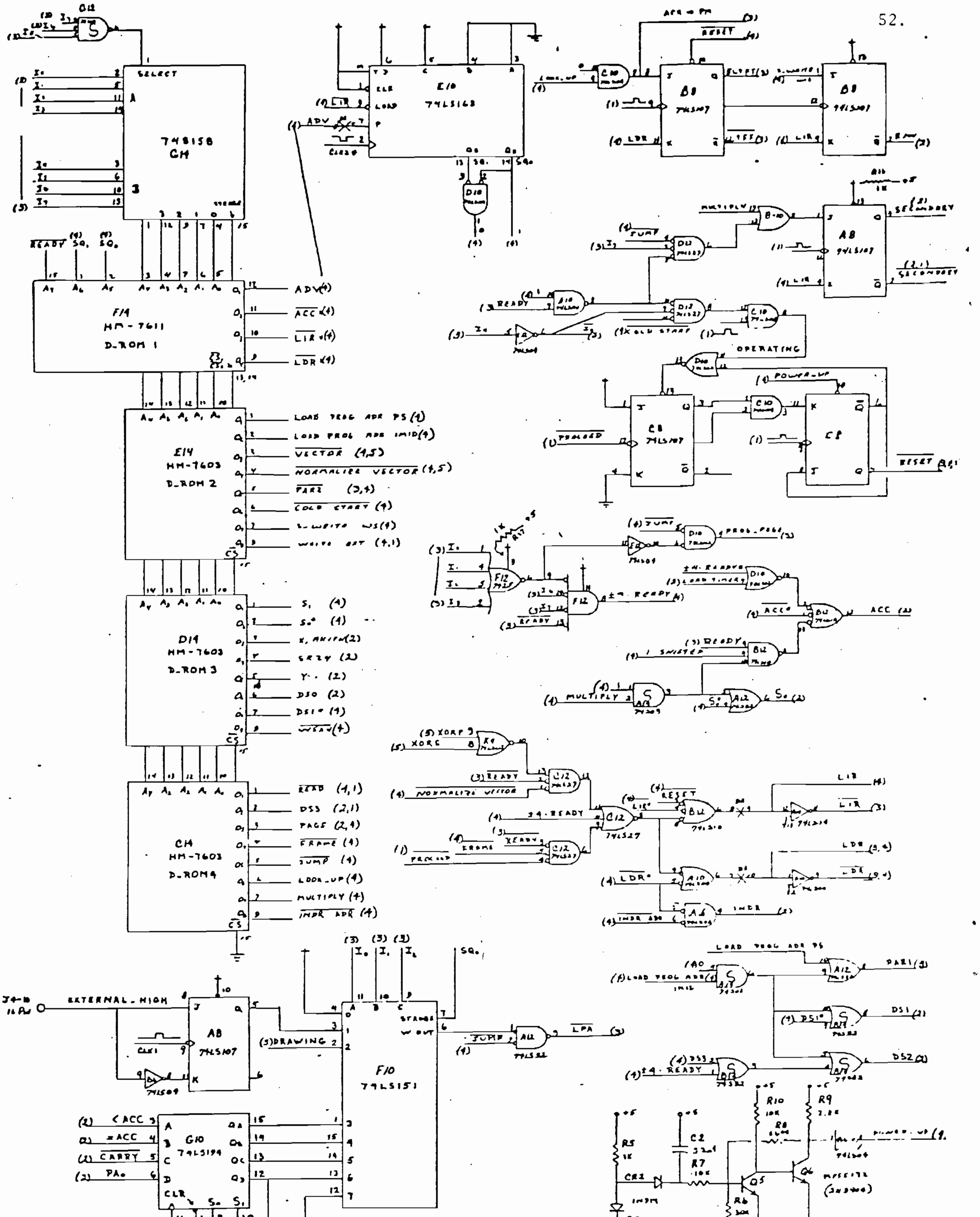
Vector Display Electronics

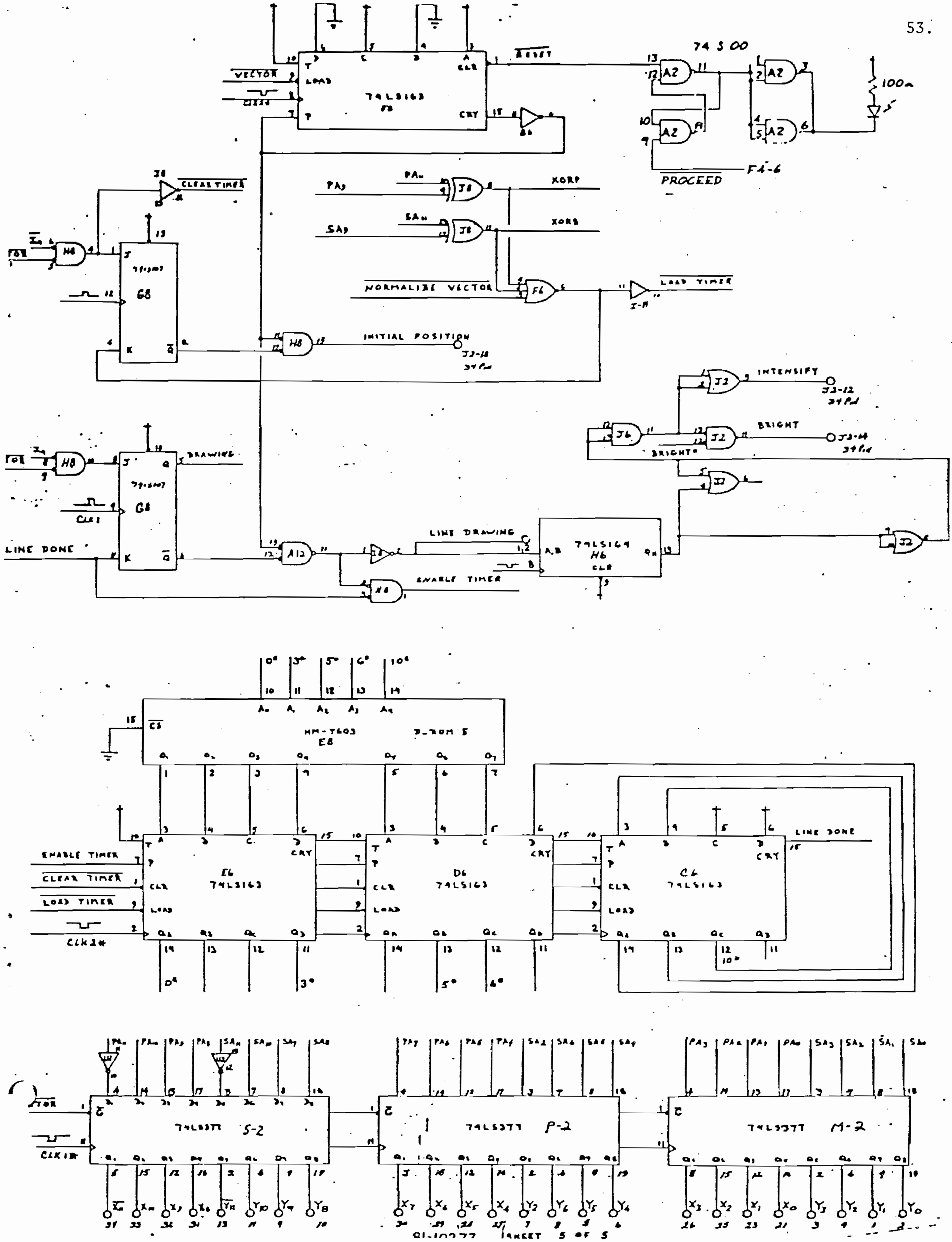

CLOCK
74265
19.923 MHz
330
330
680 pf
1/2 74S113
1/2 74S113
1/2 74S113
TP3
WRITE_EXT
WSAR
$\overline{\phi_1 + \phi_2}$
ϕ_1 OUT
ϕ_1 WSA
78KHz
10K
J4-16
PROCEED
76Hz
TP
74LS393
I4
74LS393
H4
(SEE NOTE)
CLR
G6 (SEE NOTE)
74 LS 390
G2
74S113
PR
F2
74LS259
$\overline{CLR}$
R_COIN
BRIGHTS
NOTE:
G6 OR H4 TO BE INSTALLED, NOT BOTH:
G6 FOR 50 Hz FRAME RATE,
H4 FOR 38 Hz FRAME RATE.
READ
READY
STROBE
Y OUT
E4
74LS151
D4
74LS151
C4
74LS151
RESISTOR PACK
D2
RESISTOR PACK
C2
5K TTP
1K TTP
ALL INPUTS COME FROM J3
INPUT FUNCTIONS
R.COIN
76 Hz
E2
74LS107
G2
74LS107
B4
10K
470
2N 3904
J1-12
COUNTER
2N6292
PULL UP RESISTOR TO +5
J-K FLIP FLOPS ARE 74LS107
VECTORBEAM
DPVa
7-7-78
LOGIC DIAGRAM
C
81-10273
SHEET 1 OF 5

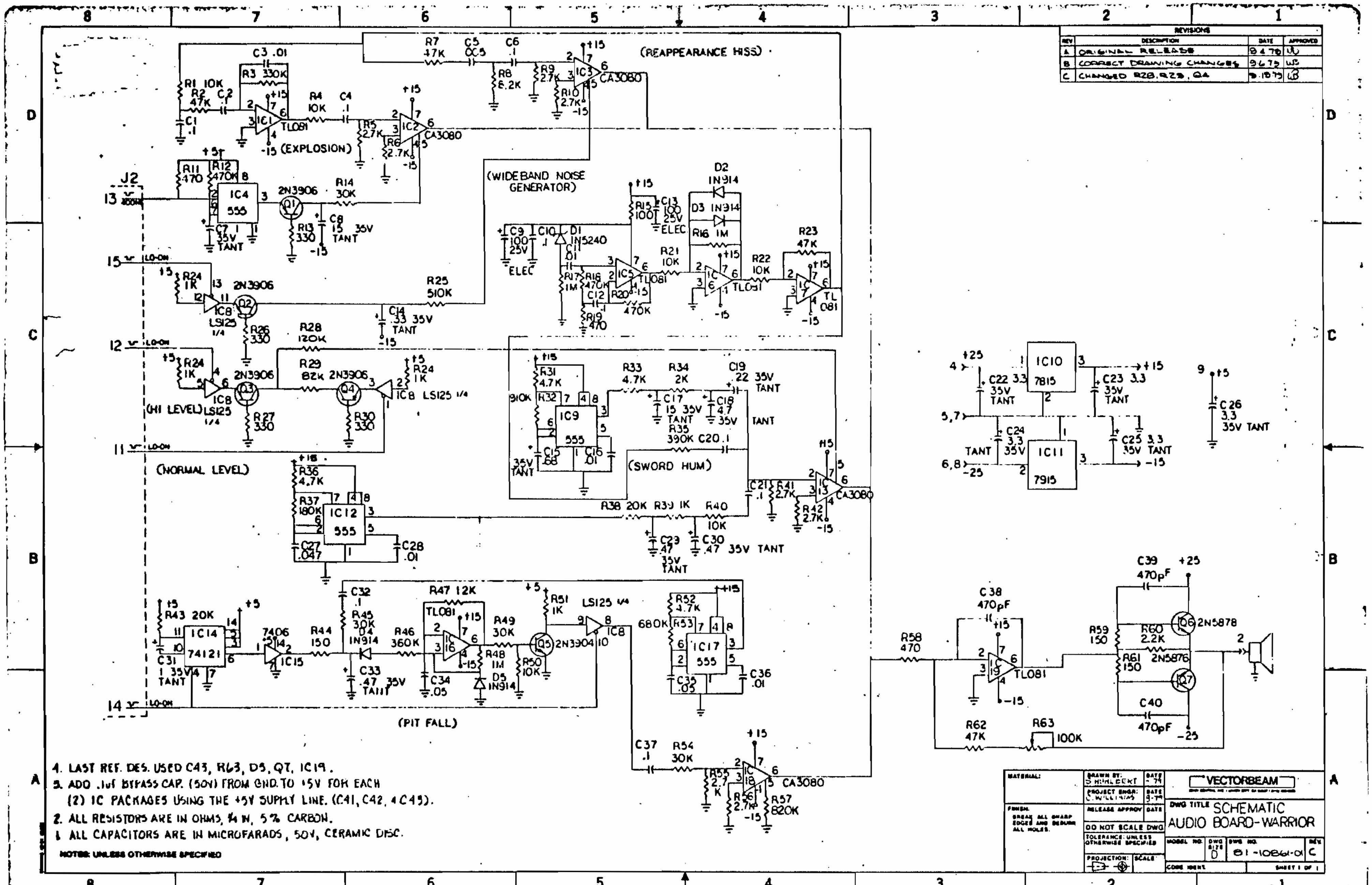

74LS157
74LS194
X, ARITH
SR24
ACC
SECONDARY
74S182
25LS181
74LS85
74S32
READ_X
DS0
DS1
DS2
DS3
9101C
74LS194
CLK
PAGE

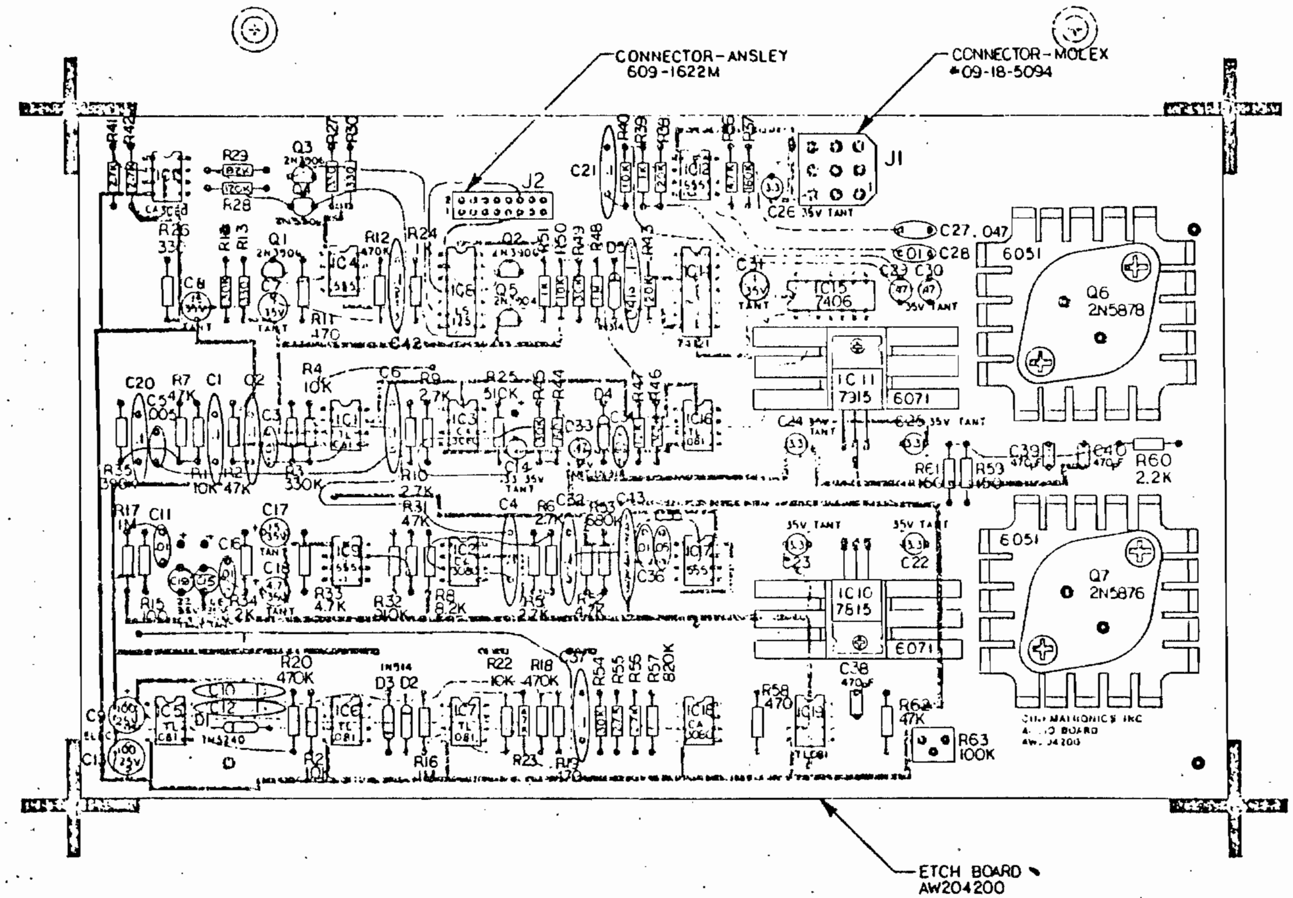


81-10273 SHEET 3 OF 5


74S158
HM-7611
D-ROM 1
E14
HM-7603
D-ROM 2
D14
HM-7603
D-ROM 3
C14
HM-7603
D-ROM 4
E10
74LS163
74LS107
A8
74LS107
C8
74LS107
F10
74LS151
G10
74LS194
EXTERNAL-HIGH
OPERATING
POWER-UP
RESET
DRAWING
R10
R9
R5
R7
R6
CR1
CR2
Q5
Q6


74 S 00
100Ω
RESET
VECTOR
LOAD
74LS163
CRY
PROCEED
F4-6
XORP
XORS
NORMALIZE VECTOR
LOAD TIMER
CLEAR TIMER
INITIAL POSITION
INTENSIFY
BRIGHT
DRAWING
LINE DONE
LINE DRAWING
ENABLE TIMER
HM-7603
E8
74LS163
LINE DONE
LOAD TIMER
74LS377
S-2
P-2
M-2
SHEET 5 OF 5


REVISIONS
A ORIGINAL RELEASE 9.4.79
B CORRECT DRAWING CHANGES 9.6.79
C CHANGED R28, R29, Q4 9.10.79
(REAPPEARANCE HISS)
(EXPLOSION)
(WIDEBAND NOISE GENERATOR)
(SWORD HUM)
(HI LEVEL)
(NORMAL LEVEL)
(PIT FALL)
J2
4. LAST REF. DES. USED C43, R63, D5, Q7, IC19.
3. ADD .1uf BYPASS CAP. (50V) FROM GND. TO +5V FOR EACH (2) IC PACKAGES USING THE +5V SUPPLY LINE. (C41, C42, & C43).
2. ALL RESISTORS ARE IN OHMS, 1/4 W, 5% CARBON.
1. ALL CAPACITORS ARE IN MICROFARADS, 50V, CERAMIC DISC.
NOTES: UNLESS OTHERWISE SPECIFIED
VECTORBEAM
DWG TITLE SCHEMATIC
AUDIO BOARD-WARRIOR
DO NOT SCALE DWG
DWG SIZE D
DWG NO. 81-10861-01
REV C
SHEET 1 OF 1



4 FILM CAP CAN BE SUBSTITUTED FOR C14, C15 & C19.

3 C41, C42 & C43 ARE BYPASS CAPACITORS.

2 ALL CAPACITOR VALUES ARE IN MICROFARADS, CERAMIC DISC, 50V.

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W 5% CARBON.

NOTES: UNLESS OTHERWISE SPECIFIED

5 NOTE ORIENTATION OF Q3 & Q4

6. C14, 15, 19 HAVE MULTIPLE MOUNTING PADS — INSTALL CAPACITORS AS SHOWN.

7. IC2, 3, 13, 18 PIN 8 ON TOS'S, PACKAGE DENOTES PIN 8

REV	REVISIONS	DATE	APPROVED
B	CHANGED R29 R28 Q4	9.19.79	
C	ADDED NOTES 5,6,7 REDREW	3.20.79	

VECTORBEAM

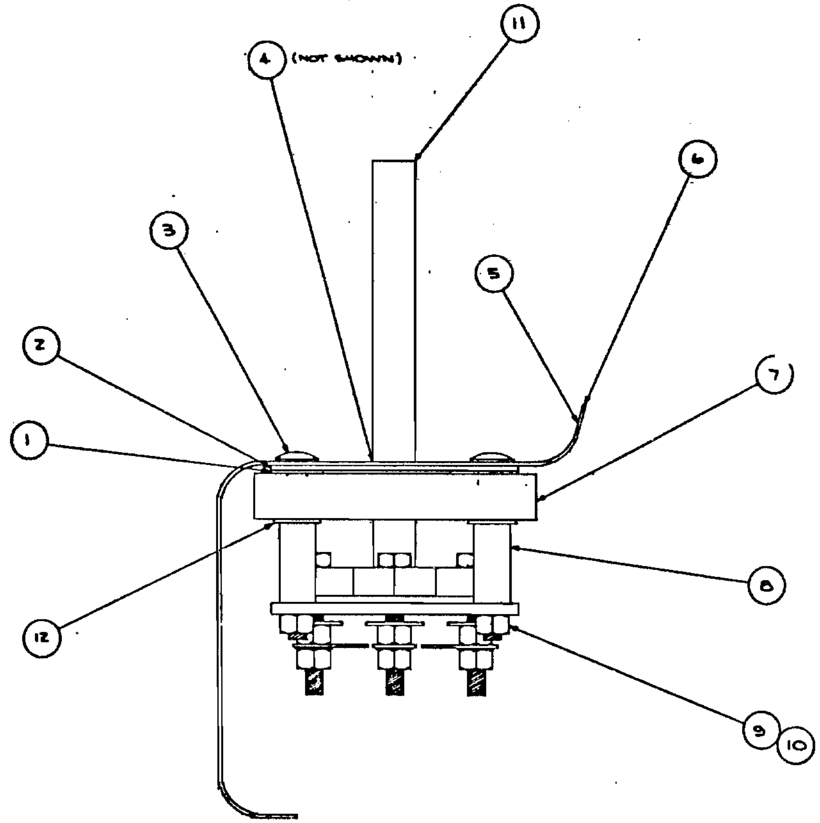
DWG TITLE: ASSEMBLY AUDIO BOARD - WARRIOR

DRAWN BY: S. HURLBERT
PROJECT ENGR: C. WILLIAMS
RELEASE APPROV: CEW
DO NOT SCALE DWG
SCALE: 2:1
DWG SIZE: D
DWG NO. 38-10805-0
REV: C
SHEET 1 OF 1

MATERIAL:

FINISH: BREAK ALL SHARP EDGES AND DEBURR ALL HOLES.

Rev	Description	Date
A	ORIGINAL RELEASE	9-20-79



Qty	Item	Part No.	Nomenclature or Description
8	12	25-10570-01	WASHER, FLAT
2	11	38-10686-01	JOYSTICK ASY
8	10	25-10571-01	HEX NUT 3/8-16
8	9	25-10701-01	WASHER, LOCK
8	8	20-10653-01	SPACER, ROUND
1	7	32-10851-01	SUPPORT, CONTROL PANEL "WARRIOR"
1	6	20-10844-01	CONTROL PANEL, "WARRIOR"
1	5	22-10852-01	OVERLAY, CONTROL PANEL, "WARRIOR"
2	4	21-10692-01	PROTECTOR SPLASH DELRIN
8	3	25-10700-01	CARRIAGE BOLT 3/8-16X3
2	2	20-10681-01	PLATE, SPACER
2	1	20-10680-01	BEZEL, JOYSTICK

PARTS LIST

VECTORBEAM

CONTROL PANEL ASSEMBLY "WARRIOR"

Drawn: DIAZ 9-17-79

Checked: [signature] 9-19-79

Application: WARRIOR TOP ASY 10-10845-01

DO NOT SCALE DRAWING

Size D — Dwg No. 38-10846-01 — Rev A

Scale FULL — Sheet 1 of 1